

# Remedial Investigation /Feasibility Study

National Smelting of New Jersey Site  
Pedricktown, New Jersey

Industrial Site  
Pedricktown, New Jersey

May 1988



54374

NL

VIA PUROLATOR COURIER

May 10, 1988

Chief, Site Investigations and  
Compliance Branch  
Emergency and Remedial Response  
Division  
U.S. Environmental Protection Agency  
26 Federal Plaza  
New York, New York 10278

Attention: Kerwin Donato, Project Officer

Re: NSNJ Pedricktown, New Jersey Facility RI/FS  
Final Site Operations Plan

The attached Final Site Operations Plan is being submitted in accordance with agreements made during our meeting of March 9, 1988, addressing the U.S. Environmental Protection Agency (USEPA) comments received on February 23, 1988. Additionally, this submittal addresses the agency comments received on March 29, 1988.

A table cross-referencing the agencies comments with the appropriate "Response Reference" is attached for your convenience. Teledyne Isotopes' responses regarding comments 43 thru 45, are similarly attached.

If you should have any questions concerning this submittal, please do not hesitate to contact me at (609) 443-2405.

Very truly yours,



Stephen W. Holt  
Senior Environmental Engineer

SWH/bt

Enclosure - Original and three copies

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**SITE OPERATIONS PLAN**

**REMEDIAL INVESTIGATION/FEASIBILITY STUDY  
NATIONAL SMELTING OF NEW JERSEY SITE  
PEDRICKTOWN, NEW JERSEY**

**O'BRIEN & GERE ENGINEERS, INC.  
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- B Sampling Equipment and Decontamination Protocol
- C Soil Sampling Protocol
- D Slag and Equipment Residue Sampling Protocol
- E Drum Sampling Protocol
- F Contained Liquid Sampling Protocol
- G Surface Water Sampling Protocol
- H Sediment Sampling Protocol
- I Ground Water Sampling Protocol
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- K Curriculum Vitae
- L Leachate Sampling Protocol
- M Monitoring Well Installation Protocol
- N Gamma Ray Logging Protocol
- O Correction to Table 7 of RI/FS Work Plan
- P Bulk and Containerized Material Inventory Protocol

**EXHIBITS**

- A Excerpt from Leggette, Brashears, Graham, Inc. Report, "Evaluation of Ground Water Conditions and Future Data Needs Concerning Lead in Ground Water at the NL Plant, Pedricktown, New Jersey," October, 1980.
- B U.S. Nuclear Regulatory Commission - "Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment" - Regulatory Guide 4.15.
- C Laboratory Protocols for Radiological Analyses
- D N.J. Department of Environmental Protection Memorandum
- E CLP Organics Data Review and Preliminary Review - SOP No. HW-4, Revision #3
- F Evaluation of Inorganic Data for the Contract Laboratory Program (CLP) based on Solicitation, Offer and Award No. WA84J091 (SOW785). September 3, 1986 - SOP No. HW-2, Revision V

**ADDENDA**

- 1 Inorganic/Organic Laboratory QA Program Manual

## SECTION 1 - INTRODUCTION

### 1.01 General

This Site Operations Plan (SOP), prepared in accordance with the Administrative Order on Consent for the National Smelting of New Jersey Site, and the USEPA Region II CERCLA QAPP Review Guidance document (April 1987), presents the specific procedures to be utilized in implementing the Remedial Investigation (RI) at the site. The SOP includes the Sampling Plan, Quality Assurance/Quality Control (QA/QC) Plan, Health and Safety Plan, and Contingency Plan for the subject Site. These plans are presented as Sections 2, 3, 4, and 5, respectively. The technical bases for the RI activities discussed herein are presented in the Remedial Investigation/Feasibility Study (RI/FS) Work Plan, which was approved by the USEPA on June 17, 1987.

The National Smelting of New Jersey (NSNJ) site is located in Oldman's Township, Salem County, New Jersey. The site, formerly owned by NL Industries, Inc. and currently owned by NSNJ, was operated as a secondary lead smelting facility. The facility was constructed during 1971 and 1972. Operations ceased in 1984. Figure 1 presents a location map for the site.

Several issues developed in the RI/FS Work Plan were noted as requiring further clarification in the SOP. These issues include the following:

- determination of the utilization of filterable and/or total metals analyses for ground water samples (Section 2.04.8),
- clarification of specific radiologic analyses for ground water samples (Section 2.04.8), and

- identification of ground water wells representative of background water quality (Section 2.04.8),

It should also be noted that the ground water quality data for observation wells RS, RD, SS, and SD as presented in Table 7 of the RI/FS work was inadvertently transposed. The corrected version of the table is presented in Appendix O.

### 1.02 Site Background

A review of site background information is presented in the RI/FS Work Plan. Although the background information review presented in the Work Plan is quite comprehensive, two pertinent areas were incompletely reviewed due to time constraints in submitting the Work Plan. Specifically, a review of historical aerial photographs and the New Jersey Department of Environmental Protection (NJDEP) files were decided to be presented in the SOP to allow for timely submission of the Work Plan.

The NJDEP files were accessed in March 1987. The intent in reviewing the NJDEP files was to determine if the files contained any previously unreviewed information that would result in a change in the scope of the RI/FS. Specific attention was given to environmental information concerning the industries adjacent to the NSNJ Site (i.e., Browning-Ferris Industries of South Jersey, Inc. (BFI), B.F. Goodrich Co. (BFG), and Exxon Chemical Americas Specialties Division, Tomah Products (Exxon/Tomah), formerly known as Nostrip Chemical Works, Inc. (Nostrip)).

The information found in the BFI files pertained to a draft New Jersey Pollutant Discharge Elimination System (NJPDDES) permit for

discharge to ground water, ground water contour maps and ground water quality data collected from 1983 through 1985. The BFG files contained well records for ground water wells located on BFG property and materials concerning the diversion of ground water for BFG's industrial and potable use. The files on Exxon/Tomah contained information regarding a NJPDES permit for discharge to ground water. The Nostrup files contained information relative to an inspection of Nostrup's wastewater treatment plant by NJDEP personnel and analytical results for samples obtained during the inspection. The review of the NJDEP files did not provide information which would warrant a change in the scope of the RI/FS as presented in the RI/FS Work Plan. The information may prove helpful, however, in the evaluation of data generated during the RI.

Historical aerial photographs were obtained for 1970, 1978, and 1982. The 1970 aerial photograph, presented as Figure 2, illustrates Site conditions prior to construction of the lead smelting facility by NL in 1972. Figure 3 presents the aerial photograph of the Site in 1978 soon after installation of the rotary kiln. The aerial photograph for 1982, presented as Figure 4, shows conditions on the Site approximately 10 months prior to the transfer of ownership of the property from NL to NSNJ. Also shown in Figure 4 are site conditions at the industries and residences in vicinity of the NSNJ Site.

## SECTION 2 - SAMPLING PLAN

### 2.01 Objective

The objective of this Sampling Plan is to provide a comprehensive document which outlines sampling locations, procedures, and practices to be used during the Remedial Investigation of the NSNJ Pedricktown Superfund Site.

### 2.02 Types of Samples

During the Remedial Investigation, several types of samples will be collected. These types of samples are as follows:

1. Soil
2. Slag
3. Equipment Residue
4. Containerized Solids
5. Contained Liquids
6. Surface Water
7. Sediment
8. Ground Water

The analytical program for the RI is presented in Table 2. A detailed schedule of sampling activities will be prepared and submitted to EPA Region II four weeks prior to sampling. The schedule will include matrix specific scheduling, however, weather conditions may impact the actual schedule. Included will be the compositing schedule at OBG Laboratories.



## 2.03 General Sample Locations and Numbers

### 2.03.01 Sample Locations

The soil samples are to be collected from a triangular grid system superimposed over the Site and surrounding area. Soil sample locations are presented in Figure 5. Slag samples will be obtained from the slag piles resident in the iron and coke bins, battery bins, and slag bins, which are presented in Figure 6. Equipment residue and containerized solids samples will be collected from locations identified during the inventory of materials at the site which will be conducted as part of the RI. Samples of contained liquids, including stormwater or wastewater, will be collected from each of the following areas if free liquids are present at the time of sampling: the pond on asphalt pavement at the east side of the plant area, the pond on concrete pavement in the center of the plant area, the acid pit, two acid tanks, thickener pit, thickener tank, wastewater tanks, effluent tank, primary and secondary leachate sumps for landfill Phases A and B, and washwater tank. These areas are identified in Figure 6, except for the leachate sumps, which are located at the landfill. Surface water and sediment sample locations are presented on Figure 7, as are the locations of the ground water wells to be sampled.

### 2.03.02 Sample Numbering System

The data management system for the field investigation will include a sample numbering and coding system. Each sample collected will be assigned a unique number which will be used by the laboratory to track that sample. In addition, each sample will be given a series of code numbers which will simplify the sorting

and acquisition of data. The codes which will be stored in the data base will include:

- date of sample collection
- time of sample collection
- type of sample collected (e.g. soil, ground water)
- horizontal location of sample point
- vertical location of sample point

Table 1 presents the sample numbering system which will be used to input data into the data management system.

#### 2.04 Sampling Equipment and Sampling Procedures

A list of sampling equipment to be utilized during the RI is presented in Appendix B. Containers for split samples for the USEPA or other regulatory agency are to be provided by the respective regulatory agency. Sampling procedures for the various matrices to be sampled are discussed below.

##### 2.04.01 Soil

Soil sampling procedures are presented in Appendix C. Composite samples will be collected to represent strata of 0" to 3", 3" to 6", 6" to 12", and 12" to 18" below grade. Soil samples from the secure landfill cover shall be to a depth of 18 inches or to the clay layer, whichever is least.

##### 2.04.02 Slag

The slag at the Pedricktown Site was generated by a rotary kiln. Accordingly, the slag is relatively fine-grained and

unconsolidated. Each slag sample will be a composite of four subsamples collected from each slag pile. Slag sampling procedures are presented in Appendix D.

#### 2.04.03 Equipment Residue

Equipment residue consists of particulate matter generated by plant operations. The sampling procedures to be utilized in collecting the equipment residue samples are presented in Appendix D.

#### 2.04.04 Containerized Solids

Containerized solids resident in drums or similar containers and identified during the inventory of materials will be sampled using the procedures presented in Appendix E.

#### 2.04.05 Contained Liquids

The procedures to be utilized in sampling the contained liquids for depths greater than 3 feet are presented in Appendix F. For contained liquid depths less than 3 feet, the procedures presented in appendix E should be utilized.

Rain water will be removed from uncovered drums utilizing a hand-operated mechanical pump. Water collected will be transferred to a suitable container for subsequent sampling with containerized liquids. One sample from the container will be obtained and analyzed in accordance with the containerized liquid analytical plan.

#### 2.04.06 Surface Water

Surface water samples are to be obtained using the procedures presented in Appendix G.

#### 2.04.07 Sediment

The marsh and stream sediment samples are to be collected utilizing the procedures detailed in Appendix H. Samples will be collected to represent the strata from 0 to 1" below the top of sediment.

#### 2.04.08 Ground Water

The ground water sampling procedures to be utilized in collecting samples from the on-site monitoring and observation wells, and off-site private water supply wells are presented in Appendix I.

All ground water samples from monitoring and observation wells with a turbidity greater than 5 NTU's (40 CFR 141.3) will be field filtered through a 0.45 micron filter prior to preservation for heavy metals and radiological analysis. Turbidity results will be reported with analytical results. Ground water samples from the private water supply wells along State Route No. 130 will not be filtered. The rationale for utilizing filterable metals analyses in evaluating water quality in the monitoring and observation wells is well documented in the report by Leggette, Brashears, and Graham, Inc. (LBC), presented as Exhibit A.

Radiological analysis of ground water, will be conducted on samples from the on-site monitoring and observation wells identified

to be sampled in the RI/FS Work Plan. Wells included in the monitoring program are to be analyzed for gross alpha and gross beta particulate activity during the first round of sampling. In addition, samples from wells RD and 2R2 will be analyzed for radium isotopes, uranium isotopes, thorium isotopes, lead-210, and potassium-40. The identification of these specific radioisotopes to be analyzed is based on USEPA Region II comments to the RI/FS Work Plan (letter from John V. Czapor, USEPA to Stephen W. Holt, NL, dated 6/17/87) and as discussed and agreed upon with Larainne Koehler, USEPA Region II, on July 23, 1987. Specific information regarding the analysis for these parameters is presented in Section 3 and Exhibit C.

In addition, to provide information of interest to the New Jersey Department of Environmental Protection (NJDEP), supplemental unfiltered analyses will be conducted on selected wells. NJDEP interests are presented in Exhibit D. For the following wells each radiologic parameter determined on a filtered sample will have the same analysis conducted on an unfiltered sample: 3R, 4R, 5R, JD, MD, RS, RD, and 2R2.

The topographic position of the site relative to streams and marshes results in a generally radial ground water flow in the water table aquifer away from the site. Two well locations, R and J, have shown elevated ground water elevations on the site. Well RD is screened in clay and therefore would not be representative of the sand aquifer conditions. Well RS is considered to be representative of background ground water quality for the water table aquifer since it has consistently maintained a high ground water

elevation. The well J location does not appear representative of background conditions for two reasons. First, the past water quality data for the J wells suggest that these wells have been impacted by lead and sulfates. Secondly, the close proximity of a ditch to these wells suggest that the ground water elevations in these wells could be impacted by surface flow in this ditch. Therefore, Well RS is considered to be the background water table well.

The cycling of water use by ground water users results in fluctuations in the ground water elevation in the first confined monitoring wells. These pumping wells have artificially depressed the ground water elevations in the first confined aquifer to below mean sea level. The first confined aquifer ground water flow pattern in the site area is complex and the hydraulical gradient will change depending on location and extent of pumping.

As noted in Section 6.01.4 of the RI/FS Work Plan, two on-site monitoring wells are to be installed prior to commencement of the RI sampling activities. One monitoring well is to be installed in the water table aquifer and one is to be installed in the first confined aquifer, at the approximate location shown on Figure 7. The water table aquifer well will be installed in accordance with the Overburden Monitoring Well Installation Protocol presented in Appendix M. The first confined aquifer well will be installed in accordance with the Double Cased Monitoring Well Installation Protocol also presented in Appendix M. All drilling will be conducted by New Jersey State Certified well drillers. Samples of the encountered subsurface materials will be collected every 5 ft.

and/or change in subsurface material or at the direction of the supervising geologist for characterization purposes utilizing ASTM Method D-1586-67/Split Barrel Sampling as specified in Appendix M. Subsequent to installation, the wells will be gamma logged in accordance with the procedures presented in Appendix N. Should gamma logging results provide information applicable to the identification of radioactive sources then that information will be presented and discussed in the RI Report.

#### 2.04.09 Bulk and Containerized Materials Inventory

An inventory of bulk and containerized materials resident at the site will be conducted to quantify the amounts of these materials and identify their locations at the site. Mr. Stephen W. Holt, P.E., C.S.P., a former Facility Manager of Environmental Control and Safety, will assist O'Brien & Gere in identifying materials during the inventory based on his experience at the site. The procedures to be utilized during the inventory are presented in Appendix P.

#### 2.04.10 Radiation Survey

A plant-wide radiation monitoring survey will be conducted to identify possible sources of radiation on the Site. The survey will consist of a walk-through with a radiation survey meter. The survey will include buildings, storage areas, process areas, and on-site soil sampling locations. Field logs will be maintained and will include all monitoring data and observations made during the

survey. Specific procedures to be utilized during the radiation survey are presented in Appendix A.

#### 2.04.11 Field Equipment Rinse Blanks

Field sampling equipment rinse blanks will be conducted following sampling equipment decontamination at a frequency of one blank per matrix per day. Field sampling equipment rinse blanks will be analyzed for the same parameters as the samples of that particular matrix. Field sampling equipment rinse blanks will consist of pouring demonstrated analyte free water over the decontaminated piece of sampling equipment into the sample container in accordance with USEPA Region II's CERCLA QAPJP Review Guidance dated April 1987. Analyte free water will be provided by OBG Laboratories with quality control dictated by normal laboratory procedures.

#### 2.04.12 Duplicate Samples

Duplicate samples are defined as two distinct samples taken from the same location at same times using identical sampling equipment that has been decontaminated in a same manner. This procedure will be utilized for aqueous duplicate samples. For soil and solid waste samples, duplicates will consist of subsamples collected within 6" horizontally of each other. All subsamples from a sample location will be homogenized in the laboratory, subdivided, and submitted for analyses as two distinct samples. Duplicate samples will be taken at a frequency of 5% per matrix.



#### 2.04.13 Split Samples

A number of samples may be split with a representative of the USEPA for analysis. Split samples are defined as one distinct sample that is divided equally and sent to two different laboratories for analysis. Solid samples will be homogenized in a clean aluminum pan in the laboratory prior to splitting. Split soil samples will be placed in containers supplied by OBG Laboratories. EPA splits will be sent by OBG Laboratories to the EPA Region II designated location. The composited, homogenized soil samples will be placed in glassware supplied by a CLP approved supplier with chain of custody originating at OBG Laboratories. Ground water sample splits will be prepared by dividing each bailer contents equally between two sample containers until the required volume is obtained. Where filtration is required, the bailer contents will be filtered prior to division between the two sample containers. Preservation will then be applied to the two sample containers. Water sample splits for organics will be duplicates.

#### 2.04.14 Trip Blanks

Trip blanks for VOA analyses will be conducted in accordance with USEPA Region II's CERCLA QAPJP Review Guidance dated April 1987. Trip blanks will be conducted at a frequency of one per day per matrix sampled.

#### 2.05 Documentation

Photographs will be taken to illustrate sampling locations. The photographs will show the surrounding area and reference objects which

help to locate sampling sites. Sample site photographs will be stored in binders along with written descriptions identifying each photograph.

Field notebooks will be utilized to record data on activities performed at the site. As such, entries will be described in as much detail as possible so that anyone going to the site could reconstruct a particular situation without reliance on memory.

The cover of each notebook will contain:

Project Number

Project Name

Start Date

End Date

Entries into the notebook will contain a variety of information. At the beginning of each entry, the date, start time, weather, all field personnel present and level of personal protection being used will be entered. The names of visitors to the site, all field sampling team personnel and the purpose of their visit will be recorded in the field notebook.

All measurements made and samples collected will be recorded. All entries will be made in ink with no erasures allowed. If an incorrect entry is made, it will be crossed out with a single strike mark and initialled. Wherever a sample is collected or a measurement is made, a detailed description of the location of the sample shall be recorded. All equipment used to make measurements will be identified.

Samples will be collected following the procedures documented in this plan. The equipment used to collect samples will be noted, along with the time of sampling, sample description, location, depth at which

the sample was collected, volume and number of containers. Sample numbers will be assigned prior to going on-site.

#### 2.06 Control of Contaminated Sampling Materials

Contaminated disposable sampling and safety equipment may be generated during sampling operations. These materials will be placed in containers. The containers will be sealed, labelled, and stored for proper disposal. Decontamination waste liquids will be incorporated into and disposed of along with the landfill leachate. The landfill leachate presently is hauled under manifest to Dupont's registered facility in Deepwater, New Jersey.

#### 2.07 Sample Control

Serialized sample labels will be used to label each sample for analysis. Chain-of-custody records (see Figure 8) will be completed for all samples according to EPA requirements and procedures set forth in NEIC Policies and Procedures (EPA-330/9-78-001-R, Revised June 1985). Custody seals will be placed on all shipping coolers containing samples. Appendix J further details sample control procedures.

#### 2.08 Sample Containers and Sample Preservation

Table 3 presents the required sample containers, preservatives, and sample volumes for the analytical procedures to be conducted during the RI. Sample containers for storage will be purchased from a CLP supplier. Lexan tubing for solid matrix sampling will be purchased from a commercial plastics supplier.

## 2.09 Sample Shipping

Samples will be packed and labelled according to DOT regulations. Samples will be shipped to the analytical laboratory so the samples can be analyzed within the holding times identified in Table 3. The date of sampling is identified as day 0 relative to specified holding times.

## SECTION 3 - QUALITY ASSURANCE/QUALITY CONTROL PLAN

### 3.01 Project Description

The RI for the NSNJ Pedricktown Site is intended to:

- determine the nature and extent of environmental conditions resulting from secondary lead smelting and related activities on the Site,
- determine what risks to human health and the environment exist due to the environmental conditions, and
- to identify remedial technologies that may be appropriate for application at the Site.

The FS for the Site is intended to evaluate viable remedial alternatives and to recommend a remedial alternative for implementation. The recommended remedial alternative will be that alternative that is cost-effective, technically feasible, and reduces impacts on human health and the environment to an acceptable level, in accordance with the National Contingency Plan (NCP) and the Superfund Amendments and Reauthorization Act (SARA). The FS will also include a conceptual design of the recommended remedial alternative.

Eight tasks have been identified to accomplish the objectives of the RI. Table 4 presents the list of tasks, their expected durations, the sequence of tasks, and the organization(s) primarily responsible for the implementation of each task. A description of each task follows:

#### Task 1 - Access Procurement

The RI includes the collection of samples from off-site private properties. Accordingly, access to those properties will need to

be obtained prior to the commencement of sample collection. Task 1 provides for the procurement of property access agreements. NL Industries, Inc. (NL) will be responsible for obtaining access agreements. This task is expected to take 60 business days to complete, and will begin upon regulatory approval of the Site Operations Plan.

#### Task 2 - Site Investigation Support

Site Investigation Support activities will include the installation of two on-site ground water monitoring wells, inventory of bulk and containerized materials, and the plant-wide radiation survey. This task is expected to require 30 business days to complete and may commence upon regulatory approval of the Site Operations Plan. OBG will be primarily responsible for this task. Monitoring well installation will be conducted by a well driller certified by the State of New Jersey. Well locations, survey locations, and other pertinent details are presented in the RI/FS Work Plan and Section 2 of the Site Operations Plan (i.e., Sampling Plan).

#### Task 3 - Site Investigation - Round 1

The Round 1 Site Investigation will include the collection of surface soil, sediment, ground water, surface water, and waste material samples. This task has an expected duration of 30 business days, and can commence upon successful completion of Task 1 and 2. OBG will be primarily responsible for the Round 1 Site Investigation. Sample locations, descriptions, and other pertinent

details are presented in the RI/FS Work Plan and Section 2 of the Site Operations Plan (i.e., Sampling Plan).

#### Task 4 - Laboratory Analysis - Round 1

Samples collected during Task 3 will be analyzed for inorganic, organic, and/or radiological parameters, as discussed in the RI/FS Work Plan. The inorganic and organic analyses will be conducted by OBG Laboratories, Inc. (OBG Labs), whereas the radiological analyses will be conducted by Teledyne Isotopes, Inc. (Teledyne). The analyses are anticipated to require 40 business days from verified time of sample receipt (VTSR) to complete. Task 4 can commence upon completion of Task 3, although sample holding times will in some cases require that samples be analyzed prior to the completion of Task 3. Details relevant to Task 4 are provided later in this section.

OBG Labs is not currently involved in the USEPA's Contract Laboratory program (CLP). OBG Labs does provide analytical services for various state regulatory agencies and actively participates in several performance evaluation sample programs. These programs include the following:

- New York Department of Health - Potable water and wastewater, hazardous and solid waste, and air emissions
- New York Department of Environmental Conservation - Superfund
- New Jersey Department of Environmental Protection - Potable water and wastewater

- Pennsylvania Department of Environmental Resources - Potable water
- U.S. Environmental Protection Agency - Several Superfund sites (Crab Orchard, Ill., NL/Taracorp, Granite City, Ill.), dioxin, CLP organics

In accordance with Region II CERCLA QAPP Review Guidance, the QA Program Manual for OBG Labs is presented as Addendum 1 to this SOP. The QA/QC guidelines adhered to by Teledyne are presented in Exhibit B.

#### Task 5 - Data Analysis

Following the completion of Task 4, the analytical data will be evaluated. The analytical results will be provided to the USEPA when available. In addition, the ground water data will be evaluated to determine whether additional off-site wells are needed to determine the extent of ground water contamination. A discussion regarding the ground water data evaluation relative to the need for additional off-site wells will be submitted to the USEPA. If data generated indicates a need for changes in any aspect of the SOP this will be presented within this report. OBG will be responsible for this task, which is expected to take 30 business days for completion.

If additional off-site wells are needed, the project duration would be extended. It is anticipated that 60 business days would be required to obtain property access for the installation of off-site wells. In addition, it is expected that 30 business days would be needed to install and develop the wells. Property access



procurement will be the responsibility of NL. A well driller certified in the State of New Jersey will install the off-site wells.

#### Task 6 - Site Investigation - Round 2

The Round 2 Site Investigation, which will include the collection of ground water and surface water samples, will commence after Task 5 is successfully completed. OBG will be responsible for its implementation. Task 6 is expected to require 30 business days to complete.

#### Task 7 - Laboratory Analysis - Round 2

The samples collected during the Round 2 Site Investigation will be analyzed for inorganic, organic, and/or radiological constituents as presented in the RI/FS Work Plan. The same laboratories utilized for the analysis of the Round 1 samples will be utilized for those collected during Round 2. The analyses are expected to require 40 business days from VSTR to complete. Details relative to Task 7 are provided later in this section.

#### Task 8 - Data Analysis and Draft RI Report

The analytical data obtained during Task 7 will be evaluated, along with the data from Task 4. A Draft RI Report will be prepared presenting the results of the RI. Included in the draft report will be a discussion of the analytical data generated during the RI, a scientific literature search regarding lead contamination and a list of remedial alternatives to be evaluated as part of the FS. This task is anticipated to require 90 business days to

complete. Details regarding the RI Report are discussed in the RI/FS Work Plan. OBG will be responsible for implementing Task 8.

#### Task 9 - Final RI Report

The Draft RI Report, generated as part of Task 8 will be submitted to the USEPA, Region II for review. USEPA comments to the Draft RI Report will be incorporated into the report and will result in the Final RI Report, which will be submitted for USEPA approval. OBG will implement Task 9, which is expected to require 30 business days to complete.

Upon approval of the Final RI Report, OBG will conduct the remaining tasks involved in the FS, which include:

- Task 10 - Remedial Alternatives Development
- Task 11 - Remedial Alternatives Screening
- Task 12 - Remedial Alternatives Evaluation
- Task 13 - Draft RI/FS Report
- Task 14 - Final RI/FS Report

Details regarding these tasks, which will be conducted by OBG, are discussed in the RI/FS Work Plan.

#### 3.02 Project Organization and Responsibility

The project organization for the NSNJ Pedricktown RI/FS is presented in Figure 9. The USEPA, Region II is the regulatory agency responsible for the project. NL, being a potentially responsible party as defined by CERCLA, has taken the initiative to implement the RI/FS. OBG is serving as Engineering Consultant to NL and will conduct the

RI/FS, with OBG Labs and Teledyne as laboratory subcontractors. Installation of ground water monitoring wells will be conducted by a well driller certified in the State of New Jersey.

The curriculum vitae of all professionals expected to participate significantly in the implementation of the RI are presented in Appendix K. Included in Appendix K is a description of the responsibilities and levels of effort of each such professional. Table 5 lists the primary contacts from each organization.

### 3.03 Quality Assurance Objectives

#### 3.03.01 Overall Objectives

The general quality assurance objective is to document that environmental monitoring data are of known and acceptable quality.

For this project, the specific objectives for measurement data in terms of precision, accuracy and compatibility are similar to the objectives established for the Statement of Work for the U.S. EPA Contract Laboratory Program (CLP), viz.: "The purpose of the QA/QC program....is the definition of procedures for the evaluation and documentation of subsampling, analytical methodologies, and the reduction and reporting of data. The objectives are to provide a uniform basis for subsampling, sample handling, instrument condition, methods control, performance evaluation, and analytical data generation and reporting." This QA/QC Plan for sampling, analysis and data handling is consistent with the requirements set forth by Test Methods for Evaluating Solid Waste,

November, 1986 (SW-846). Specific QA/QC is identified for those parameters requiring special analytical services.

### 3.03.02 Field QC Objectives and Procedures

The objective of sampling procedures is to obtain samples that are representative of the environmental matrix being investigated. Trace levels of contaminants from external sources will be eliminated through the use of good sampling techniques and proper selection of sampling equipment.

A detailed description of sampling procedures is presented in the Sampling Plan (i.e., Section 2).

The Sampling Plan includes the following protocols and documentation.

- Number of locations to be sampled
- Sampling procedures to be used at the site
- Tests to be completed at each sampling location
- Sampling equipment required at the site
- Sample containers required at the site
- Preservation methods to be used at the site for various types of samples
- Reagents, etc., required at the site for sample preservation
- Shipping containers required at the site
- Chain-of-custody procedures to be used at the site
- Shipping methods and destinations, marking instructions, special labels, etc.

### 3.03.03 Field QC Audits

Blanks and duplicate samples will be collected as part of the QA/QC program. Blanks are employed to document that neither glassware nor procedural contamination has occurred. Additionally, they are utilized to evaluate ambient site conditions which may cause sample contamination. If positive interferences occur, the QA/QC Officer will recommend to the Project Manager that sample collecting and handling procedures be technically reviewed to eliminate such sample contamination.

Duplicate samples are treated throughout as two unique samples with separate sample numbers. The results of duplicate analyses provide information on the overall precision of both the sampling and analytical programs.

Field duplicate and blank samples for the Round 1 and Round 2 Site Investigations are summarized in Section 2 (i.e. Sampling Plan) of the SOP. Laboratory matrix duplicates and matrix spikes are included in Tables 6, 7, 8, 9, 10, 11, 12, and 13.

### 3.03.04 Field Quality Control

Bound log books and appropriate data sheets will be used to document the collection of samples so that any individual sample can be traced back to its point of origin; sampler and sampling equipment.

Duplicate and blank samples (see Section 2 - Sampling Plan) will be collected at the same time, employing the same procedures, equipment and containers as the scheduled sample.

Additionally, duplicate and blank samples will be packaged and shipped to the laboratory in the same manner as the required sample.

As specified in Section 3.07 (i.e. Data Reduction, Validation and Reporting) of this QA/QC Plan the QA/QC Officer will periodically review the results of the duplicate analyses and advise the OBG Project Manager of any problems.

Field measurements of pH, temperature and specific conductance will be taken on water samples only. The pH meter will be checked against two known standard pH buffers (4 and 10 standard units) before and periodically during its use each day. The power supply for the pH meter will be checked before each sample is monitored.

Conductivity readings will be made with a portable specific conductivity meter. The meter will be calibrated with a 0.010 normal potassium chloride solution (KCl) at least twice per day. The power supply for the conductivity meter will be checked before each sample's conductivity is measured.

#### 3.03.05 Accuracy, Sensitivity and Precision of Analysis

Samples collected during the RI will be analyzed using procedures presented in Tables 6, 7, 8, 9, 10, 11, 12, and 13. Tables 6, 7, 8, 12, and 13 reference method detection limits, audit, frequency, control limits, average accuracy, precision and completeness for all parameters shown in Table 2 to be analyzed using non-CLP methodologies. The QC criteria for the parameters

identified in Tables 9, 10, and 11 are included in the referenced CLP Statement of Work.

### 3.04 Sampling Procedures

The objective of following carefully designed and documented sampling procedures is to obtain samples that represent the environmental matrix being investigated. Cross contamination from external sources will be eliminated through the use of sampling techniques outlined for each sample matrix in the Sampling Plan.

The following matrices to be sampled and analyzed as part of the RI are discussed in detail in the Sampling Plan and appending protocols.

- °Soil
- °Slag
- °Equipment Residue
- °Containerized Solids
- °Contained Liquids
- °Surface Water
- °Ground Water

### 3.05 Equipment Calibration

#### 3.05.01 Calibration Procedures

##### Equipment Calibration, References and Frequency

All equipment used during this project will be calibrated and operated in accordance with the manufacturer's instructions.

## Standards

### A. General

Standards may be generally grouped into two classifications: primary and secondary. Primary standards include United States Pharmaceutical (USP), National Bureau of Standards (NBS), and American Society for Testing and Materials (ASTM), and certain designated EPA reference materials. All other standards are to be considered secondary.

### B. Testing

1. Primary: No testing is necessary. Do not use if there is any physical indication of contamination or decomposition (i.e. partially discolored, etc.).
2. Secondary: Examine when first received either by comparison to an existing primary, or comparison of known physical properties to literature values.

### C. Records

1. A records book will be maintained for each grouping of standards (i.e. pesticides, metals, etc.)
2. The record kept for each standard will include:
  - a. Name and date received
  - b. Source
  - c. Code or lot number
  - d. Purity
  - e. Testing data including all raw work and calculations
  - f. Special storage requirements
  - g. Storage location



- h. Age (Shelf-life)
- i. Last verification date
- 3. These records will be checked periodically as part of the Laboratory Controls Review.

## Equipment

### A. General

- 1. The analytical equipment to be used in this project includes those instruments listed in Section 3.07.

### B. Testing

- 1. Each form details both preventative maintenance activities and the required QA testing and monitoring.
- 2. In the event the instrument does not perform within the limits specified on the monitoring form, the Laboratory Manager will be notified and a decision made as to what action to take.
- 3. If repair is deemed necessary, an "out of order" sign will be placed in the instrument until repairs are effected.

### C. Records

- 1. A bound notebook will be kept with each instrument requiring calibration, to record all activities associated with a maintained, QA monitoring and repairs program.
- 2. These records will be checked during periodic equipment review.

### 3.06 Analytical Procedures

The analysis and methods detection limits for first and second round analytical parameters are given in Tables 6, 7, 8, 9, 10, 11, 12 and 13. Specific procedures associated with parameters requiring special analytical services are provided in individual laboratory addendums (see Addenda).

When analyzing samples by the above-referenced standardized methods, the accuracy or precision of the data generated by the laboratory is determined through analysis of replicates, spiked samples, synthetic reference standard samples, and/or field or laboratory blanks along with each set of samples. Any interferences are identified and documented.

In general, the method accuracy is determined by spiking the sample matrix with the analyte at a minimum of three concentration levels. The range of the spiking levels is selected to bracket the concentration of interest. For radionuclides, spikes are conducted at one level which is typically 5 to 10 times background environmental levels. Percent recoveries of the spikes are calculated and are compared with synthetic standards. The method precision is determined by analyzing a minimum of three replicates at each spiking level. The precision is evaluated by calculating the standard deviation.

The data generated is, whenever possible, input to the laboratory base data management system. Analyst's work sheets are filed for one year as a temporary record. When approved and signed, data reports and pertinent information are reported to the client.

### 3.07 Data Reduction, Validation, and Reporting

#### 3.07.01 Data Reduction

Laboratory facilities performing analyses on first and second round samples are identified in Table 5. The following data handling procedures are employed at OBG Laboratories, Inc.

A. Gas Chromatography/Mass Spectrometry: A Hewlett-Packard Model 5987A GC/MS with Telemar Model 400 Dynamic Head Space concentrator equipped with a RTE6 VM Operating System which uses an Aquarius Package and a 5996 HP GC/MS with a 7672A HP Auto Sampler and a RTE6 VM operating system which uses an Aquarius Package are used for positive identification and quantification of volatile organics and sample extracts. Output from the GC/MS units is processed for presentation in three formats:

- 1) A real-time total multiple ion mass chromatogram.
- 2) A post-run investigation report containing the following:
  - a. Retention time
  - b. Response factor
  - c. Primary, secondary and tertiary ion with their correspondings abundance
  - d. Quantitation ion
  - e. Reference library name
  - f. Concentration
- 3) A visual comparison of the subject mass spectral output to the library compound.

The post integration report contains the following:

- 1) Listing of all compounds.
- 2) Relative retention times.

- 3) Relative response factor to their internal standards.
- 4) Concentration of compounds, surrogate and internals.

Quality Assurance/Quality Control data such as resolution and calibration standards and DFTPP spectra are also processed and stored in the above manner.

B. Gas Chromatography: A Hewlett-Packard Model 5880A Gas Chromatograph (GC) equipped with an Electron Capture Detector and a 7673A H.P. Auto injection system is used for positive identification and quantification of sample extracts.

Output from the GC unit is processed for presentation in two forms:

- 1) A real time chromatogram
- 2) A post-run integration report containing the following:
  - a. Retention time
  - b. Response factors calculated from standards
  - c. Surrogate standard reservoir
  - d. Listing of all positively identified compounds

Quality Assurance/Quality Control data such as spikes, spike duplicates, and calibration curves are also processed and stored in post integration reports.

C. Trace Metals: A Varian model 575 Atomic Absorption Spectrophotometer (AA) and Perkin-Elmer Model 3030B Atomic Absorption Spectrophotometer with an HGA600 furnace are used for the low level detection of metals by conventional flame and graphite furnace techniques.

The atomic absorption spectrophotometer for inorganic pollutants is calibrated using appropriate calibrating

standards and blanks. The calibrations are checked by analyzing synthetic standards at five different concentration levels.

The results are used to generate standard curves by least squares fit of the data via computer programs. The deviation of the standards from the least squares fit (standard curves) and the standard deviation of the fit are printed on the daily printout and the data stored accordingly in appropriate computer bases. If deviation from accepted values occur, analysis of sample and instrumental calibrations are repeated. Standard curves are generated regularly.

- D. Spectrophotometry: Spectrophotometric instruments are initially calibrated with commercially available standards. To verify the initial calibration, EPA knowns are analyzed and must be within  $\pm 10\%$  of the true value. At a frequency of 10% a continuing calibration standard is analyzed and quantitated. If the continuing calibration standard is not within  $\pm 10\%$  the instrument is recalibrated and the previous 10 samples are reanalyzed. The chemist documents any excursions and continuing calibration on the bench analysis log.
- E. Total Organic Halogen: A Xertex/Dohrmann model DX20 Total Organic Halide Analyzer is used to estimate the quantity of halogenated organic material in a water sample. Values from the instrument (samples are analyzed in duplicate) are input to a formula used to calculate the estimated presence of synthetic chemical contamination. The TOH sample is passed over a granular activated carbon column. The carbon is

rinsed with a nitrate wash to remove ionic halides and then combusted. Combustion products are bubbled into a coulometric cell for determination of total micrograms of halides.

- F. Total Organic Carbon: A Beckman Model 915 Total Organic Carbon Analyzer is used for the determination of organic, inorganic or total carbon. TOC is determined by measuring the total carbon content and the inorganic carbon content; TOC is the difference between the two measured values. Inorganic carbon is determined by injecting the sample into an oxygen enriched furnace at 100°C and measuring the carbon dioxide evolved using an infra red detector. Total carbon is determined by injecting the sample into an oxygen enriched furnace at 950°C and measuring the carbon dioxide evolved using an infra red detector.
- G. Nephelometer: A Hach model 1680 PortaLab Turbidimeter or equivalent, will be used to determine the turbidity of ground water in the ranges of 0-1.0, 0-10, and 0-100 nephelometric turbidity units (NTU).
- H. pH meter: A Nester Instruments Mini-pH-Meter or equivalent will be used measure the hydrogen ion activity in ground water. The instrument will be standardized before each days use with 4.01 and 6.86 buffer solutions. Fresh buffer solutions will be prepared prior to field activities.

- I. **Specific Conductivity:** A YSI model 33 conductivity meter or equivalent will be utilized to measure a water samples ability to conduct electricity. The instrument will be standarized before each days use with standard potassium chloride solution 0.01N.
- J. **Inductively Coupled Plasma Emission Spectrometry (Total and Dissolved Metals, EPA Method 200.7 CLP-M):** Trace metal analyses by U.S. EPA Method 200.7 CLP-M will be performed using a Thermo Jarrel Ash ICAP-61. The ICAP-61 is a 29 channel 0.75 meter direct reading simultaneous spectrometer. Data is directly transmitted to an IBM PC/AT computer for storage and manipulation. The computer is configured with 640 KB, a single floppy 1.2 MB disk drive, and a 30 MB hard disk. A printer provides a hard copy of the analytical data, as well as a graphics display of the spectral line profiles that assists in the making interelement corrections.

The instrument is standardized daily for each element to be analysed. Standardization is confirmed by analysis of a laboratory control sample that contains each element in question. Continuing calibration standards, contract required detection limit (CRDL) standards, interference check samples, blanks, duplicates and matrix spikes are analysed to measure accuracy, precision, and matrix effects.

- K. **Data Verification:** The processed transcribed information and the hard copied raw data are reviewed by the Group Leader to verify the validity of the data and determine whether

reinjection or additional cleanup steps are required. The results of the evaluation are recorded in a notebook and input to the Sample Status File.

- L. Distribution: Following final review by the Laboratory Manager, the results of the analytical determination are shipped to the OBG Project Manager. The format used for presentation of data are those presented in the IFB forms. Additional data such as copies of raw data and chromatograms are provided upon request.
- M. In-House Storage: Results of all analytical determinations are stored in the laboratory's computer based data management system. Raw data tapes are logged into the computer on a separate file and listed by tape number and its contents. The data tapes are stored indefinitely. Should a request be made for a particular raw data tape, the tape is copied and the copy is kept in the archive while the original is sent to the Contractor. Work sheets, injection logs, and calculations are dated, initialled, and stored. All notebooks are also archived and stored in OBG Lab's Central File.

The data handling procedures employed at Teledyne are presented in Exhibits B and C.

### 3.07.02 Reporting

Once a sample has been tagged and input to the laboratory data management system, the ability exists to determine its exact status. With the available maintenance programs, and tracking



forms, the group leaders can trace the progress of one sample or an entire group of samples. Therefore, O'Brien & Gere's Project Manager is able to receive partial data before the entire program is complete.

### 3.07.03 Data Validation

Data will be validated by the individual group leaders and/or Manager of the laboratory conducting the analysis. The validation process will include the review of spike recovery, surrogate recovery, comparability of duplicate analysis, Internal Standard Recovery, field sampling equipment rinse blank and trip blank integrity. Additionally, the validation process will include checks for the adherence to accuracy and precision criteria, unusually high or low parameter values and possible transmittal errors. Also, holding times, instruments calibration, continuing calibrations, and the frequency of QC analyses are reviewed.

The data generated utilizing CLP methodologies will be validated in accordance with the EPA-Region II validation Standard Operating Procedures presented in Exhibits E and F and the referenced CLP Statement of Work. When non-CLP methodologies are utilized (e.g. SW-846, Methods for Chemical Analysis of Water and Wastes) the validation criteria presented in Exhibits E and F will be changed according to the appropriate quality control criteria identified in Tables 6, 7, 8, 12, and 13.

The Laboratory QA/QC Officers identified in Figure 9 will perform validation of the data from his/her respective laboratory.

The requirements to be checked in validation, in order, are as follows:

- I. Sample Holding Times
- II. Calibration
  - a. Initial Calibration and Calibration Verification
  - b. Continuing Calibration Verification
  - c. Calibration Blank
- III. Blanks
  - a. Field Sampling Equipment Rinse Blank
  - b. Method Blank
- IV. Interference Check Sample Analysis
- V. Laboratory Control Sample Analysis
- VI. Specific Sample Results
  - a. Duplicate Sample Analysis
  - b. Spiked Sample Analysis
  - c. AA/QC Analysis
    1. Duplicate Injections
    2. Analytical Spikes
  - d. Sample Result Verification
- VII. Field and Other QC
- VIII. Overall Case (Batch) Assessment

The reviewer will compare what was actually performed by the laboratory to the requirements of the protocols and program objectives.

### 3.08 Internal Quality Control Checks

#### 3.08.01 Analytical Quality Control

The quality control objectives for the analytical program of this project are listed in Tables 6, 7, 8, 12 and 13, as well as the CLP Statements of Work referenced in Tables 9, 10, 11. The requirements for each parameter are different, therefore, the listing identifies frequency, control limits, and audits for compound acceptability. This will include the analysis of EPA Standard reference materials or reference materials certified by NBS or made available by suppliers that participate in measurement activities with NBS (for radionuclides) where available to verify initial calibration of non CLP analysis. The criteria for acceptance will be  $\pm 10\%$  for organics and inorganics of known values. The acceptance criteria for radionuclide standards will be determined by NBS.

Matrix spikes will monitor the methodology recoveries which will be compared to Exhibit E of the WA-87-K236 (7/87) CLP protocols. Matrix spike duplicates and replicate analysis provide information on the overall precision of the analytical methodology. The quantitative results obtained by calculating the relative percent difference (RPD) will be compared to Exhibit E of the CLP protocol.

### 3.09 Audit Procedures

The USEPA may audit the performance of the laboratories utilized during the RI/FS. The USEPA may review performance evaluation samples conducted by the laboratories for regulatory agencies.

The Laboratory QA/QC Officers will maintain a record of such audits and inform the necessary agencies/project management team of significant deviations from established control limits. Should problems be encountered during analysis of samples the Laboratory QA/QC Officers, OBG Project Manager, and the Laboratory Managers will formulate recommendations to correct any deficiency with the analytical protocol or data. NL and the USEPA will be notified of any corrective measure to be implemented.

### 3.10 Preventive Maintenance

Preventive maintenance procedures will be carried out on all field equipment in accordance with the procedures outlined by the manufacturer's equipment calibration, operation and maintenance manuals.

### 3.11 Data Assessment

Analytical data will be submitted to and assessed by the OBG Project Manager and NL prior to submittal to the USEPA in accordance with their standard procedures. The assessment will be based upon usability of the data in relation to historical data, significance, impact, and action level.

The QA/QC Officers, with laboratory group leaders, will identify any data that should be rated as "unacceptable" or "preliminary", and take corrective actions, if deemed necessary.

The Laboratory QA/QC Officer of each laboratory utilized has the responsibility of assessing the quality of the data generated by their respective laboratory.

### 3.12 Corrective Action

Corrective action procedures that might be implemented from audit results or upon detection of data unacceptability are developed on a case-by-case basis.

The actions may include:

- Reanalyzing samples if holding time requirements have not been exceeded.
- Altering field or handling procedures.
- Resampling.
- Using a different batch of sample containers.
- Recommending an audit of laboratory procedures.

The QA/QC Officer is responsible for initiating the corrective action. The Laboratory Manager is responsible for approving the corrective action.

Corrective action procedures that might be implemented in the field are developed during the initial field investigation.

The field actions may include:

- recalibrating instrumentation
- replacing instrumentation
- modifying sampling methodology
- altering sample handling procedures
- resampling

All field corrective actions shall be approved by the project manager. All field corrective actions will be noted in the field logs.

### 3.13 Quality Assurance Reports

The Laboratory QA/QC officers will provide documentation stating that he/she has validated the data of his/her respective laboratory in accordance with the EPA - Region II protocol presented in Exhibits E and F, or, when quality control criteria are established according to the dictates of the method (i.e., non-CLP analyses), the laboratory is responsible for validating the data in accordance with the quality control criteria referenced in Section 3.07.3. A document delineating the criteria used will be provided to the EPA along with the quality assurance summary sheets, and, when applicable, the EPA - Region II Standard Operating Procedure validation checklist. The summary sheets will be taken from the CLP Statement of Work, the third edition of SW-846, or be based thereon. Data analysis sheets will be provided for each environmental sample listing the quantities observed or the method detection limit.

*Obtained from Site Operations Plan*

*O'Brien + Gere Eng. Inc.  
dated May 1988*

#### SECTION 4 - HEALTH AND SAFETY PLAN

##### 4.01 Introduction

This document is the Health and Safety Plan for site activities to be conducted during the Remedial Investigation (RI) being performed on and in the vicinity of the National Smelting of New Jersey Site (also referred to as the NSNJ Pedricktown Site) by O'Brien & Gere Engineers, Inc. (OBG) and associated subcontractors.

All personnel (here defined as employees of OBG, employees of all subcontractors, respondents, all visitors and representatives from the EPA, State, local groups, media, etc.) will be required to follow and adhere to the procedures set forth in this plan. All personnel will also be required to report to the Site Health and Safety Officer (SHSO) or his designated on-site representative before proceeding on-site.

The RI of the Site will involve operations conducted over several months duration which are addressed by this Health and Safety Plan. Safety procedures to be employed throughout the project will be in compliance with all current and applicable OSHA requirements.

##### 4.02 Background Information

###### 4.02.01 Identification

Site Name: National Smelting of New Jersey Site

Address/Location: Penns Grove - Pedricktown Road  
Pedricktown, New Jersey

Project Description: Remedial Investigation/Feasibility Study  
(RI/FS)

On-Site Work Dates: Duration anticipated to be six months  
(work dates dependent on approval of Site Operations Plan)

Overall Degree of Hazard: Low to moderate

Key Personnel for RI/FS

U.S. EPA Contact: Mr. Kerwin Donato (212) 264-5397

U.S. EPA Designated Representatives:

Mr. Dhruva Kanjarpane - NJDEP (609) 633-0701

Mr. Lewis Horzempa - Ebasco (201) 460-6113

NL Contact: Mr. Stephen W. Holt (609) 443-2405

O'Brien & Gere Contact: Mr. Frank D. Hale (315) 451-4700

O'Brien & Gere Safety Officer: Dr. Swiatoslav Kaczmar  
(315) 451-4700

#### 4.02.02 Site Description

Type of Facility: Inactive secondary lead smelting site.

Size: Study area includes approximately one square mile of which  
46 acres is defined as the site.

Buildings: Numerous (see Figure 6)

Surrounding Land Uses: Industrial, Agricultural, and Residential

Layout: See Figure 6



#### 4.02.03 Site History

The Pedricktown secondary lead smelter was constructed in 1971-72. NL Industries terminated lead production using the rotary kiln on May 27, 1982. NL sold the facility to NSNJ in February, 1983. NSNJ ceased operations at the facility and filed for bankruptcy in May, 1984. A detailed description of the site development, secondary lead processing, site clean-up, and the transfer of the smelting facilities ownership to NSNJ, is presented in Section 2 (i.e. Site History) of the RI/FS Work Plan.

#### 4.02.04 Summary of Site Hazards

The Pedricktown site has been determined to represent the following potential hazards:

- Soil, sediment, surface and ground water indicate presence of several heavy metals, most notably lead (Pb). See Tables 1, 2, 5, 6, 7, 8, 9 and 10 of the RI/FS Work Plan for matrix analytical results.
- Bulk and containerized materials (both raw materials and waste materials) are present at various locations on the site. The raw materials have sufficient lead concentrations to be suitable for recycling. Analyses of rotary kiln slag are presented in Table 4 of the RI/FS Work Plan.
- Physical structures including buildings, ladders, walkways, and equipment may pose a hazard due to poor lighting and their state of disrepair.

#### 4.02.05 Project Description and Purpose

The RI will include those activities necessary to determine the nature, extent and concentration of on-site materials, wastes and environmental contaminants. In addition, off-site soil lead contamination will be evaluated. Field activities will primarily be conducted during the RI.

The Feasibility Study (FS) will identify, screen and evaluate the appropriate remedial actions for the site, based on existing data and information gathered during the RI. This work phase is primarily engineering design evaluation and is to be conducted off-site.

#### 4.03 Hazard Evaluation/Site Characterization

##### 4.03.01 Previous Monitoring Performed On-Site

NL operated the facility from 1972 through 1982. Environmental monitoring identified lead contamination of certain soils on the plant property. The RI/FS Work Plan summarizes the analytical results of environmental monitoring during this timeframe. Prior to selling the facility to NSNJ in February 1983, NL had complied with all cleanup measures of the plant area as dictated by Consent Order to the satisfaction of the NJDEP.

NSNJ operated the facility until January 20, 1984. NSNJ allowed rotary kiln slag, along with other bulk and containerized waste materials and raw materials (e.g., ore concentrates, fluxes, and reagents) to accumulate in non-enclosed areas on the site. Therefore, it is expected that the bulk and containerized material

at the site consists of lead oxide, rotary furnace slag, equipment residue, and raw materials, all resulting from NSNJ's operation of the site. These materials typically contain from 5% to 50% lead.

Current soil lead concentrations on and around the site will be better defined during the RI. However, analytical results from soil samples obtained prior to NL's cleanup of the site indicates that surface soil lead concentrations from areas that were not excavated ranged from 35 to 36,500 ppm (dry weight) with a geometric mean of 494 ppm. Only 4 of 23 samples from these areas were greater than 3,000 ppm. Since NSNJ operated the facility for less than one year, whereas NL operated the facility for approximately ten years, it is likely the soil lead concentrations presented above are representative of present conditions.

Previous studies regarding bulk and containerized solids are limited to analyses of rotary furnace slag. The slag underwent analysis for EP Toxicity metals (Table 2 of RI/FS Work Plan) for which each sample exhibited concentrations below the EP Toxicity Limits. The total lead concentration of the rotary furnace slag was typically approximately 78,000 mg/kg.

NL established a permitted hazardous waste landfill on the facility's property. The landfill consists of two phases. Landfill Phase A contains process wastes whereas Landfill Phase B also contains hard rubber case material and lead contaminated soils excavated from the facility's grounds. Exhibit D of the RI/FS Work Plan presents analytical results from primary and secondary leachate sump samples from Landfill Phase A and Landfill Phase B.

Representative concentrations of leachate constituents are presented below:

Antimony	0.5-6.8 mg/l	Manganese	0.67-23 mg/l
Arsenic	0.006-227 mg/l	Selenium	0.009-.075 mg/l
Cadmium	0.01-0.31 mg/l	Tin	0.5-13 mg/l
Lead	0.5-24.6 mg/l	Chloride	164-19,300 mg/l
Iron	1.1-12,300 mg/l		

During the period from 1981 through 1983 marsh water samples were collected by NL and analyzed for a variety of parameters. Representative concentrations are summarized as follows:

Arsenic	0.016-0.78 mg/l
Cadmium	0.02-0.42 mg/l
Chloride	335 mg/l
Iron	6.3-43,000 mg/l
Lead	2.75-7.52 mg/l
Manganese	0.45-11.7 mg/l
Selenium	LT 0.005-0.097 mg/l
Sulfate	246-15,500 mg/l

Previous hydrogeologic investigations have identified three water bearing units beneath the site which are outlined in Section 6.01.4 of the RI/FS Work Plan. Tables 6 and 9 in the RI/FS Work Plan illustrate data summarized since 1981 regarding on-site ground water monitoring and observation wells and nearby private water supply wells.

#### 4.03.02 Previous Levels of Personnel Protection

NL's employee safety program required that half face respirators with dust, fume, mist and radionuclide cartridges were worn in the area identified as Zone I on Figure 6 when the plant was operating. Entry into baghouses and confined areas required full face respirators. Personal monitoring and air monitoring conducted in the battery yard during periods when the plant was operating indicated that respiratory protection was not necessary. However, all personnel in this production department were required to wear respiratory protection to simplify administration of safety procedures.

#### 4.03.03 Hazardous Materials On Site

The hazardous materials potentially on the Pedricktown site are:

Arsenic	Selenium
Cadmium	Antimony
Lead	Soda Ash
Sulfuric Acid	
Copper	

Media in which the potentially hazardous materials listed above may be present are: soil, slag, containerized material, equipment residue, surface wastes, and ground water. Based on available information, metals other than lead are present as minor components in lead-bearing raw materials, products, or contaminated environmental media. Consequently, the levels of protection will be targetted at lead and areas where sulfuric acid may be present.

#### 4.03.04 Specific Hazards

Routes of exposure of site workers to the previously mentioned hazardous components include all of the following:

- ingestion and/or inspiration of heavy metal dust
- direct contact via skin, eyes, or mouth for corrosives (acids and alkalis)

The specific hazards of the materials are briefly described below:

1. Lead and other metals - Lead is a toxin in elevated levels, having a detrimental affect on nervous system, kidney, blood and bone marrow. The other metals affect target organs similar to lead. Major routes for absorption are via consumption and inspiration. In all cases, the level of hazard correlates to the level of exposure.
2. Acids and Caustics - The primary acid which may be present at the site is sulfuric acid; the primary caustic which may be present is soda ash. Both acids and caustics exhibit corrosive effects to body tissue (e.g., eyes, skin) upon contact. Inhalation causes a burning sensation of mucous membranes of the upper respiratory tract.
3. Metallic Sodium and Red Phosphorus - These raw materials are reactive with water or oxidizing agents. Labelled raw material containers will not be opened or moved during RI/FS activities.

#### 4.03.05 Monitoring Program

##### Radiologic Monitoring Program

Appendix A (Radiation Survey Protocol) of this document identifies the equipment and procedures to be utilized while conducting the on-site field investigation. As part of the inventory investigation radiation measurements will be obtained in areas where waste material has been stored, leachate sumps, storage tanks and pits and at selected points about the Landfill area. Background radiation measurements will be obtained along the outer perimeter of the facility property line.

In addition a reading will be taken at each of the following upwind locations:

- Intersection of Benjamin Green Road and Pedricktown - Penns Grove Road.
- Intersection of Benjamin Green Road and US 130.
- Intersection of Porcupine Road and US 130.

#### 4.03.06 Training Program

Training is essential for all workers at the site. Workers must be thoroughly familiar with the Site Health and Safety Plan and must be trained to work safely in contaminated areas. Each organization conducting activities at the site will be responsible for administering a Health and Safety Training Program in accordance with OSHA Interim Standard covering workers involved in Hazardous Waste Operations for all personnel involved in field activities.

OBG employees will be trained in accordance with OSHA regulations prior to arriving at the site for field activities. OBG will also provide all subcontractors with the requirements for compliance with OSHA regulations.

Visitors to the site must sign a statement asserting that they are aware of the OSHA regulations pertaining to activities at a hazardous waste site and have received adequate health and safety training in accordance with the regulations. OBG will assume no responsibility for the health and safety relative to the OSHA regulations of visitors to the site, or anyone else other than employees or subcontractors of OBG.

#### 4.04 Site Control

Three work zones have been identified for the Pedricktown facility and environs on Figure 6. The office building and shipping office will support additional field equipment and personal protection equipment during the on-site Field Investigation. This area serves to limit the spread of contaminated materials should additional equipment be necessary throughout a single day's sampling activities. Each individual on-site should be conscientious of limiting the spread of contaminated materials.

In addition, all personnel should practice caution around any equipment and structures which could represent a physical hazard. The on-site safety officer should be consulted if any questions exist concerning physical hazards associated with sample collection.



#### 4.04.01 Health and Safety Management and Responsibilities

Site Health and Safety Officer (SHSO) - Swiatoslav Kaczmar, Ph. D., C.I.H., shall serve as OBG's SHSO for this project. Dr. Kaczmar has direction over the safety of operations and health and safety of all contractor personnel. Following an initial safety reconnaissance Dr. Kaczmar may designate an on-site representative to institute required procedures.

Subcontractors and Government Oversight Personnel - All subcontractors are required to adhere to the requirements of this Health and Safety Plan. They may upgrade their level of personal protection where necessary in order to comply with their own corporate Health and Safety requirements, so long as their requirements meet or exceed those of this plan.

#### 4.04.02 General Requirements for Entry in Contaminated Zones

Before proceeding onto the site past the Entry and Exit Point, all personnel as identified in subsection 4.01 shall:

1. Be advised of the Health and Safety Plan, instructed in safety procedures and aware of potential hazards.
2. Be properly dressed and equipped.
3. Notify the SHSO or his designated representative.

All personnel entering into areas or performing tasks requiring respiratory protection shall:

1. Have been qualitatively fit tested and have medical approval.
2. Be clean shaven in areas where the mask touches the face.
3. Have had necessary respiratory training.

#### 4.04.03 Site Entry and Exit (E&E) Procedures

Site entry and exit points are located on Figure 6.

Entry procedures are as follows:

1. Personnel dressout and activate necessary monitoring equipment.
2. All personnel (or team/task leader) notify the SHSO of intended operations.
3. SHSO or his designated representative reviews team personnel with respect to subsection 4.03.6 above.
4. Entry time and personnel are logged.
5. Team proceeds through the designated, controlled E&E point.

Exit procedures are:

1. All personnel exit through the designated E&E point.
2. All personnel go through appropriate decontamination (See Subsection 4.07).
3. All personnel are logged out and time recorded.

#### 4.04.04 Daily Start-up and Shut-down Procedures

Start-up procedures are:

1. SHSO reviews site conditions with respect to modifications of work and safety plans.
2. Personnel and team briefing, review and update of safety procedures.
3. Check out of safety and monitoring equipment.
4. SHSO ensures that first aid station is operable.

5. SHSO initiates appropriate monitoring.
6. Team dress out, proceed to Tasks.

Shut-down procedures are:

1. All personnel exit and decontaminate.
2. SHSO logs all personnel out.
3. When appropriate, the SHSO performs a site walk to ensure that all personnel are off site and that the site is secure.
4. Equipment and site are secured.

#### 4.04.05 Heat/Cold Stress

During weather above 70 deg F, or any conditions of excessive humidity, workers will be routinely observed for symptoms of heat stress. Heat stress will be prevented by judicious work scheduling, periodic breaks, and the availability of a shaded, cool resting area and cold fluids.

The workers will be routinely observed for symptoms of cold stress (shivering, numbness, low body temperature, drowsiness, and marked muscular weakness) and frostbite (flushed skin color, pain, blister, numbness and pale, glossy skin). Cold stress and frostbite will be prevented by limiting exposure to extreme cold, wearing proper protective clothing, keeping moving and avoiding overexertion.

#### 4.05 Personal Protective Equipment

##### 4.05.01 Contact Protection

Protective equipment requirements are determined by the location of activities as well as the particular activities required. The area encompassed by the Field investigation is divided into three zones relative to personal protective equipment.

Zone I includes enclosed spaces which during smelting operations required respiratory protection as well as open areas in the vicinity of the enclosed spaces. The enclosed areas contain lead dust which could be suspended by movement through the area as well as sampling activities. The Zone I area is identified on Figure 6.

Zone II includes the paved areas of the site which are open to the atmosphere as indicated on Figure 6. These areas did not require respiratory protection during smelting operations. Bulk and containerized materials in Zone II could contain lead concentrations in excess of 10,000 mg/kg. Sampling would agitate these materials and could increase air particles at the sample location.

Zone III includes unpaved areas within the fenced boundary of the site shown in Figure 6. Available testing indicates soil samples in this area have an average lead concentration of less than 500 mg/kg, however, localized areas may have soil lead concentrations above 5,000 mg/kg.

The following levels of protection will apply.

##### 1) Zone III

The level of protection required during all activities in the Zone III areas as delineated on Figure 6 includes the following protective equipment:

- Work uniform
- Foul weather gear (if inclement weather)
- Boots with steel toes and shank
- Surgical gloves\*
- Safety eye wear\*\*

## 2) Zone II

The following protection equipment, in addition to that specified above for Zone III, will be required during all activities in the Zone II area delineated on Figure 6:

- Hard hat
- Chemical-resistant overboots
- Half-face, air purifying respirator (OSHA/NIOSH approved) with dust, fume, mist, and radionuclide cartridge\*
- One-piece Tyvek<sup>R</sup> coveralls, (hood optional)
- Chemical resistant outer gloves\*

\* Required for sampler, optional for observer.

\*\*Required for sampler and all personnel within 10 ft. of sampling activities, or if within enclosed area.

## 3) Zone I

The same protective equipment required for the Zone II activities will be required for all activities in Zone I, except that the one-piece hooded Tyvek<sup>R</sup> coverall is required. In addition, a full-face, air purifying respirator (OSHA/NIOSH approved) with dust, fume, mist, and radionuclide cartridges will be required when sampling or inside the following enclosed spaces: bag houses, fuchs, and buffer storage building.

#### 4.06 First Aid For Exposure

The following is a general description of first aid measures to be employed on-site. In all cases of symptoms of chemical exposure, first aid treatment is to be followed by a full medical examination.

##### 4.06.01 Inhalation

Symptoms: dizziness, nausea, lack of coordination, headache, irregular rapid breathing, weakness, loss of consciousness, coma.

Treatment:

1. Bring victim to fresh air. Rinse eyes or throat if irritated.
2. If severe (victim vomits, is very dizzy or groggy, etc.) evacuate to a hospital.
3. Be prepared to administer CPR.
4. Evacuate victim to hospital.

##### 4.06.02 Dermal

Symptoms: Same as above. Solvents may produce irritation, rash, or burning.

Treatment:

1. Flush affected area with water for 5 minutes.
2. Cover with a clean dressing.
3. If CNS symptoms develop, evacuate victim to hospital.

##### 4.06.03 Ingestion

Symptoms: Same as above, with stomach cramps.

Treatment:

1. Evacuate victim to hospital.
2. If any sign of burns are obvious, do not induce vomiting.

#### 4.06.04 Eye Contact

Symptoms: Redness, irritation, pain, impaired vision.

Treatment:

1. Flush with water for at least 15 minutes using a portable eyewash unit.
2. If severe, evacuate victim to a hospital.

#### 4.06.05 Medical Surveillance Program

While in operation as a secondary lead smelter, the following raw materials may have been used and may present an exposure at the site:

- heavy metals, including lead and arsenic
- caustics including soda ash
- spent battery acid.

Individuals conducting on-site activities will be subjected to blood lead analyses. In addition, the radiation monitoring program outlined in Section 4.03.5 will be included in the Medical Surveillance Program. Each employee of OBG and its subcontractors engaged in on-site activities will have blood lead testing conducted. At a minimum, blood lead testing shall be conducted prior to starting work on the site and at the completion of on-site activities. The frequency of additional blood lead testing shall be determined by OBG's Health and Safety Coordinator, the examining physician, and OSHA requirements.

O'Brien & Gere has established a medical monitoring program to identify, monitor, and prevent health risks for employees potentially exposed to hazardous materials. All employees who

participate in field activities where hazardous wastes might be present are required to participate in this program. This program has two essential components, routine health care and emergency medical care, as described below:

1. Pre-employment medical examinations to establish the individual's state of health, baseline physiological data, and ability to wear personal protective equipment
2. Annual physicals for field personnel
3. Whenever a situation occurs at a site which may pose a significantly increased health risk to any personnel, or personnel exhibit currently job-related physical conditions, the Health and Safety Coordinator may recommend that such individuals consult with the examining physician for examination and treatment in accordance with good medical practice.

Annual physical examinations may include an EKG, chest X-ray, or pulmonary function as determined by the examining physician in conjunction with O'Brien & Gere's Health and Safety Coordinator.

Following the completion of each previously described medical examination, the following shall be conducted:

- The examining physician or appropriate representative will discuss with each individual the results of their medical examination.
- The examining physician or appropriate representative will notify O'Brien & Gere's Health and Safety Coordinator in writing that the individual has undergone a complete medical examination. In addition, O'Brien & Gere's Health and Safety



Officer shall be advised as to any medical condition that the physician feels would adversely affect the individual's ability to work under conditions requiring the use of personal protective clothing.

#### 4.07 Decontamination

##### Personnel

All personnel involved in the field investigation will go through a decontamination program prior to leaving the study area. Decontamination protocols will be dictated by the work area and levels of protection employed. A description of work areas is presented as Section 4.05.

##### 4.07.01 Zone I Decontamination Procedures

- A) The decontamination outlined is for workers wearing Zone I protection including taped joints between gloves and cover boots, and Tyvek<sup>R</sup> suits when they exit Zone I and enter Zone II.
- B) Procedures for Decontamination
  - 1. Deposit equipment used in Zone I (tools, sampling devices and containers, monitoring equipment, etc.) on plastic drop cloth or in different containers with plastic liners. Decontaminate sample equipment in accordance to matrix decontamination protocols in Appendices. Place all clean equipment on plastic drop cloth or in clean plastic bag.
  - 2. Boots, gloves, and Tyvek<sup>R</sup> coveralls will be rinsed with clean water. Rinse water will be containerized and disposed of properly.

3. Remove outer gloves and discard.
4. Remove respirator if worn, avoiding hand to face contact and place respirator in a clear plastic bag.

The exact locations for decontamination will be identified in the field.

#### 4.07.02 Zone II Decontamination Procedures

- A) The decontamination outlined is for workers wearing Zone II protection consisting of equipment outlined in Subsection 4.05 when they exit Zone II and enter Zone III.
- B) Procedures for Zone II Decontamination
  1. Equipment which is to remain in Zone II shall be placed in a transparent plastic bag labeled dirty and placed inside the door of the shipping office. The door which enters the shipping office at this point will be considered "dirty".
  2. Deposit equipment used in Zone II (tools, sampling devices and containers, monitoring equipment, etc.) on plastic drop cloth or in different containers with plastic liners. Decontaminate sample equipment in accordance to matrix decontamination protocols in Appendices. Place all clean equipment in a clean transparent plastic bag marked clean.
  3. Boots and gloves will be washed, scrubbed, and rinsed with a detergent/water solution, a long handled medium coarse brush and tap water. Rinse water will be containerized and disposed of properly.

4. After personal protective equipment and sampling equipment decontamination, remove and discard outer gloves, if present, Tyvek coveralls, and all disposable equipment to a drum.
5. Upon leaving the Zone II decontamination area workers must then proceed through Zone III decontamination prior to leaving the study area.

Note that the exact locations for decontamination will be identified in the field.

#### 4.07.03 Zone III Decontamination Procedures

- A) This level of protection has been designated for all activities in the Zone III area at the Pedricktown site.
- B) Procedure for Full Decontamination
  1. Deposit equipment (tools, sampling devices and containers, monitoring instruments, radios, clipboard, etc.) on drop cloths or in heavy duty plastic bags.
  2. Remove boots and place in designated area.
  3. Remove gloves, if present, and dispose in the designated container.
  4. Remove and place work uniform into the marked storage area after each use. The work uniform may be reused by the crew member until either the crew member or the SHSO determines that they should be discarded.
  5. Wash hands and face and move to clean area.
  6. Dress in street clothes and leave through specified clean entry exit point.

Note that the exact locations for decontamination will be identified in the field.

#### 4.07.04 Heavy Equipment

Vehicles entering any of the three zones will be cleaned at the truck washing pad used during facility operating and identified on Figure 6. Equipment will be cleaned with tap water, soap as needed, brush scrub for caked on soils, and triple tap water rinse. Wash and rinse water will drain to an existing wastewater collection sump. Wastewater will be managed in the same manner as other liquids per Section 2.06.

#### 4.08 Emergency Information

##### 4.08.01 Emergency Telephone Numbers

New Jersey State Police Woodstown Barracks: 609-769-0774

Local Fire Department: 609-935-4505

Local Ambulance Service: 609-935-4505

Hospital (Emergency): 609-935-1000 (Primary)

609-853-2000 (Secondary)

Poison Control Center: 1-800-962-1253

Procedures for contacting emergency personnel:

- a. State your name, location and nature of emergency.
- b. For hospital victim.
  - Name and phone of family or emergency physician, if known.
  - Description of incident - chemicals involved, symptoms, nature of injury, proposed treatment, plan of transportation.

#### 4.08.02 Directions to Hospital

##### Primary Hospital

Salem County Memorial Hospital - State Route 130 South to Salem.

##### Secondary Hospital

Underwood - Memorial Hospital - State Route 130 north, exit at Red Bank Avenue, bear right on exit ramp, turn right onto Red Bank Avenue.

#### 4.08.03 Procedures for Serious Injury/Exposure

1. Perform necessary emergency first aid or treatment.
2. Evacuate all personnel from area if dangerous.
3. Notify SHSO.
4. Call appropriate emergency support.
5. Perform secondary first aid and prepare victim for transport.
6. Evacuate victim to hospital.
7. Notify hospital of the incoming patient and type/severity of injury and exposure.

#### 4.08.04 Procedures for Fire

1. Isolate the location of the fire and alert on-site personnel.
2. If possible, contain the fire. A fire extinguisher will be available at the entry and exit point, and at the command post.
3. Notify the fire department.
4. Evacuate the immediate area if fire cannot be contained.

## SECTION 5 - CONTINGENCY PLAN

### 5.01 Introduction

Emergencies at a hazardous waste site are conditioned by the nature of the site. A Contingency Plan is a written document, established before work on the site begins, outlining policies and procedures for responding to and handling emergencies. Types of emergencies that are possible:

- major medical emergency
- structural failure
- liquid or solid hazardous materials spill
- a fire or explosion
- toxic vapor release
- a flood
- major chemical exposure

When an emergency occurs, decisive action is required. Delays of minutes can create life threatening situations. A response needs to be immediate and accurate.

#### 5.01.01 Site Topography/Access

The topography of the region that includes the site is flat to gently rolling land which slopes north. The site is approximately ten feet above sea level. The Delaware River lies approximately 1.5 miles to the northwest of the site.

The on-site structures and former processing equipment are numerous. The surface about these structures is composed of asphalt and concrete. Access to the plant area is available at two

locations as identified in Figure 11. A road exists perpendicular to Penns Grove - Pedricktown Road on the west side of the facility. From this point the road intersects the Pennsylvania - Reading Seashore Lines railroad tracks and continues as an access road to the top of the landfill. The right of way also encompasses the base of the landfill.

#### 5.02 Personnel

Table 14 contains the emergency response phone numbers to be used in this subsection.

#### Emergency Response

The SHSO (or on-site representative) will be responsible for implementation of control over emergency situations. In an emergency this individual must be notified of the following essential information:

What happened:

- Type of incident
- When incident occurred
- Where incident occurred
- Cause of incident (to be verified by subsequent investigation)
- Extent of damage
- Extent of chemical release

Casualties:

- Victims (number, location, and condition)
- Treatment Administered

- Treatment Required
- Missing Personnel

After assessing the emergency, the SHSO, in conjunction with a NL representative, will notify the appropriate emergency response personnel. The SHSO will alert on-site personnel as to the nature of the emergency and provide instructions regarding evacuation, if necessary. In the event that evacuation is necessary, work should be stopped immediately and the site evacuated. Figure 11 illustrates the site control points that should be used should an emergency situation develop.

Available information about potential incidents and emergency response capabilities should be evaluated. Determine to the extent possible:

what could happen. Consider:

- types of chemicals on-site
- potential for fire, explosion and release of hazardous substance
- location of all personnel on-site relative to hazardous areas
- potential for danger to off-site population or environment

what can be done. Consider:

- equipment and personnel resources needed for victim rescue and hazard mitigation.
- number of uninjured personnel available for response.
- resources available on-site and from off-site groups and agencies.
- time for off-site resources to reach the site.



- hazards involved and limitations.

Pedricktown site procedures for emergencies will be determined and coordinated by the SHSO or his designated representative on-site.

The SHSO or his designate will contact the appropriate response organization as soon as possible. Off-site Emergency Response Organizations are listed on Table 14.

#### Emergency Communication

The following standard hand signals will be used in case a worker is unable to speak:

Hand gripping throat - out of air can't breathe

Grip partner's wrist or place hands around waist - leave area immediately

Index finger across throat and rolling of hands - stop work, leave area immediately

Hands on Top of Head - Need assistance

Thumbs Up - OK, I'm all right, I understand

Thumbs Down - No, negative

### 5.03 Site

#### Emergency Evacuation

In case of an emergency, all personnel should evacuate the site through site control points 1 or 2 illustrated on Figure 11 and gather at the assembly area noted on Figure 11 to ensure that all personnel are accounted for. It is the responsibility of the SHSO (or on-site representative) to inform all personnel entering the work site of potential

hazard areas, site control points, and the locations of project work areas.

The SHSO (or on-site representative) is responsible for controlling the entry of personnel into the Work Area and knowing the location of on-site personnel at all times. Site sampling vehicles will be utilized for refuge to escape inclement conditions or should immediate site evacuation becomes necessary.

In the event an incident threatens the health or safety of the surrounding community, the public will be informed and emergency procedures be coordinated with the appropriate off-site agencies. The SHSO (or on-site representative) in conjunction with an NL representative will coordinate these efforts.

#### 5.04 Medical/First Aid

Required medical treatment may range from bandaging minor cuts to providing life saving first aid and immediate medical transport. There should be at minimum one individual on-site at all times who is responsible for emergency first aid procedures. These persons should be identified as such for the information of others on-site. Basic first-aid supplies will be stored in the sampling vehicle. Should an injury occur, the transportation route to the nearest hospital is identified in Table 14 (i.e. Emergency Response Organization).

#### 5.05 Equipment

Site personnel will adhere to the requirements for the level of personal protective equipment as specified in Section 4, (i.e. Health and Safety Plan) of this document.

In the event of a small controllable fire, a fire extinguisher will be located in NL site trailer. The trailer is located south of Phase "B" of the landfill adjacent to the Pennsylvania - Reading and Sea-Shore Lines railroad. A fire extinguisher will also be located with the sampling vehicle.

Sampling equipment such as shovels, trowels and nonflammable geophysical equipment may be used to control and contain sudden emergency situations such as fires or spills.

#### 5.06 Emergency Procedures

##### Fire Fighting Procedures:

Fire extinguishers are to be located in the NL site trailer. Fire extinguishers should be utilized to control small fires upon initial development. Where a fire cannot be controlled by mechanical means the area should be evacuated immediately and Emergency Response actions be implemented. The Emergency Response Organizations Table (i.e. Table 14) identifies local and National Response Organizations.

##### Spill Response Procedures:

New Jersey Water Pollution Control Regulations (7:1E-2) state, with regards to discharge notification and response, that for any discharge of any hazardous substance which is in such quantity or concentration as may be harmful, or which poses a foreseeable risk of harm to public health or welfare or to natural resources, must be reported immediately to the NJDEP at:

(609) 292-5560 (24 hours, 7 days a week)

The following information must be provided in the report:

- Type of substance discharged and the estimated quantity.
- Location of the discharge regarding ground and surface waters.
- Actions proposed to contain, cleanup and remove the discharge.
- Relevant information requested by NJDEP.

A written confirmation of the notification of discharge must be submitted to the Department within 60 days after giving notice as stated above. Confirmation letters, including a description of the event, the source of discharge, cleanup and removal measures taken, and steps to prevent a recurrence, are to be sent to:

Office of Hazardous Substances Control  
Division of Water Resources  
P.O. Box 2809  
Trenton, New Jersey 08625  
Attention: Discharge Confirmation

Notification duties will be the responsibility of OBG personnel. Documentation of spill event for project and site records is also required, following all necessary containment, cleanup and disposal activities.

#### 5.07 Documentation/Reporting

Following an emergency response, emergency equipment must be recharged, refilled, or replaced, in order to be fully prepared for the next potential emergency. Government agencies such as OSHA, EPA,

DOT, and state agencies, must be notified of the incident as appropriate.

An investigation of the incident will be conducted as soon as possible after an incident. The results of an emergency response investigation will be documented in a report by OBG. The report may be used as a training and information tool to prevent a future recurrence.

# Tables



**O'BRIEN & GERE**

NLI 001 0619

Table 1  
Sample Numbering System

<u>Matrix*</u>	<u>Sample Type</u>	<u>ID 1</u>	<u>ID 2</u>	<u>ID 3</u>
Soil	1	001-299	(1)	(2)
Marsh Sediment	2	300-399	(1)	(2)
Sediment	3	400-499	(1)	(2)
Ground Water	4	500-799	(3)	(4)
Surface Water	5	800-899	-	-
Contained Liquids	6	1000-3999	(5)	-
Containerized Solids	7	1000-3999	-	-
Equipment Residue	8	4000-4999	-	-
Slag	9	5000-5999	-	-

NOTES:

\* - indicates that each sample obtained for the specified matrix will be identified with the date of collection and a laboratory number.

(1) - indicates the distance from grade to the top of core.

(2) - indicates the distance from grade to the bottom of core.

(3) - indicates the distance from grade to the bottom of the screened interval.

(4) - indicates the length of the screened interval.

(5) - indicates distance from surface.

ID 1 - sample number

ID 2, ID 3 - sample depth identifier

Table 2  
Pedricktown RI/FS  
Analytical Program

Sample Matrix	Lab Sieve <sup>(1)</sup>	Digestion	Filtration	Analytical Series <sup>(2)</sup>									
				A	B	C	D	E	F	G	H	I	J
Soil	140	140	-	140	14	-	-	-	-	-	-	-	-
Slag	3	3	-	3	-	3	-	-	-	-	-	-	-
Equipment Residue	10	10	-	10	(3)	-	-	-	-	-	-	-	-
Containerized Solids	25	25	-	25	(3)	-	-	-	-	-	-	-	-
Containerized Liquids <sup>(4)</sup>	-	-	-	20	-	-	20	20	-	-	4	-	-
Surface Water													
- Round 1 Water	-	-	-	11	1	-	11	-	-	-	-	-	-
- Round 2 Water	-	-	-	11	1	-	11	-	-	-	-	-	-
- Sediment	-	11	-	11	1	-	-	-	-	-	-	-	-
Marsh Sediment	-	8	-	8	-	-	-	-	-	-	-	-	-
Groundwater													
- Water Table Aquifer													
Round 1	-	-	24	-	-	-	-	-	24	3 <sup>(5)</sup>	-	-	-
Round 2	-	-	24	-	-	-	-	-	24	-	-	3 <sup>(6)</sup>	2
- 1st Confined Aquifer													
Round 1	-	-	4	-	-	-	-	-	4	1	-	-	-
Round 2	-	-	4	-	-	-	-	-	4	1	-	-	-
- Off-site													
Round 1	-	-	-	-	-	-	-	-	9	-	-	-	-
Round 2	-	-	-	-	-	-	-	-	9	-	-	-	-

Notes:

- (1) - Lab sieving indicates that soil samples will be sieved through a sixteen mesh stainless steel sieve after drying (8 hrs. at 100 C, or until dry), prior to analysis. Slag samples will be dried and sieved through a 9.5 mm standard sieve in the laboratory prior to analysis.
- (2) - A indicates total lead.  
B indicates total metals (antimony, arsenic, cadmium, chromium, copper, selenium, tin, and zinc.)  
C indicates EP Toxic metals.  
D indicates pH.  
E indicates TOC.  
F indicates antimony, arsenic, cadmium, chromium, copper, lead, selenium, gross alpha and beta, sulfate, chlorides, pH (field), conductivity (field), TOC, and TOH.  
G indicates cyanide and priority pollutant metals.  
H indicates TOH, gross alpha and gross beta.  
I indicates organic chemicals listed in Tables 9-11.  
J indicates total and filterable radium, uranium and thorium isotopes, Pb-210, and potassium-40.
- (3) - Total metal analysis will be conducted on unknown samples.
- (4) - Actual numbers of samples will be determined in the field, as discussed in section 6.01.2. For estimating purposes, it is anticipated that 20 samples will be obtained.
- (5) - Any of the parameters identified in any of these three samples within 75% of Primary Drinking Water Standards will be added to all well samples in subsequent sampling and analysis.
- (6) - As determined from TOC and TOH results of first round sampling.



TABLE 3  
CONTAINER/ PRESERVATION LIST

PARAMETER	CONTAINER/PRESERVATIVE	(1) HOLDING TIME	VOLUME REQUIRED	COMMENTS
Solids	Whirl-pak/glass	6 months	75 ml	ambient
Volatiles (water)	40 ml vials/HCL	10 days	40 ml (2)	Cool 4 C., pH <2
AE/BN (water)	4 glass liter/none Teflon liner	5 days	1 L	Cool 4 C
PCB (water)	glass liter/none Teflon liner	5 days	1 L	Cool 4 C
Pesticides (water)	glass liter/none Teflon liner	5 days	1 L	Cool 4 C
Total Organic Halides	8 oz. amber glass/ H2SO4 Teflon septa	7 days	200 ml (2)	Cool 4 C., pH <2
Trace Metals	pint plastic/HNO3	6 months	500 ml	pH <2
Mercury	pint P or G/HNO3	26 days	500 ml	pH <2
Chloride	pint P or G/none	28 days	50 ml	-
Cyanides	pint plastic/NaOH	14 days	500 ml	Cool 4 C., pH >12
Sulfate	pint P or G/none	28 days	50 ml	Cool 4 C
Total Organic Carbon	amber glass or plastic /HCL or H2SO4 Teflon liner	28 days	25 ml	Cool 4 C., pH <2
Gross alpha	1 gal. P or G/HNO3	6 months	1 l	-
Gross beta	1 gal. P or G/HNO3	6 months	1 l	-

Note: All plastic bottles will be polyethylene.

(1) Where preservative is being added a separate aliquot will be tested with preservative to demonstrate that the volume of preservative added will adjust pH to the required value. Tests will be conducted at a frequency of one per sample event per preservative.

TABLE 4

## RI OPERATIONS SCHEDULE AND FUNCTIONAL ACTIVITIES

<u>Task/Activity</u>	<u>Duration</u> <sup>(1)</sup>	<u>Predecessor</u>	<u>Responsible Company</u>
Task 1 - Access Procurement	60 days	Approval of Site Operations Plan	NL Industries, Hightstown, New Jersey
Task 2 - Site Investigation Support	30 days	Approval of Site Operations Plan	O'Brien & Gere Engineers, Inc., Edison, New Jersey
Task 3 - Site Investigation - Round 1	30 days	1	
3.1 - Soil Investigation			O'Brien & Gere Engineers Inc., Edison, New Jersey
3.2 - Stored Material Investigation			O'Brien & Gere Engineers Inc., Edison, New Jersey
3.3 - Surface Water and Marsh Investigation			O'Brien & Gere Engineers Inc., Edison, New Jersey
3.4 - Hydrogeologic Investigation			O'Brien & Gere Engineers Inc., Edison, New Jersey
Task 4 - Laboratory Analysis - Round 1	40 days	3	
4.1 - Inorganic/Organic Analysis			OBG Laboratories, Syracuse, New York
4.2 - Radiological Analysis			Teledyne Isotopes, Westwood, New Jersey
Task 5 - Data Analysis	30 days	4	O'Brien & Gere Engineers Inc., Edison, New Jersey
Task 6 - Site Investigation - Round 2	30 days	Approval of 5	
6.1 - Hydrogeologic Investigation			O'Brien & Gere Engineers Inc., Edison, New Jersey
6.2 - Surface Water and Marsh Investigation			O'Brien & Gere Engineers Inc., Edison, New Jersey
Task 7 - Laboratory Analysis - Round 2	40 days	6	
7.1 - Inorganic/Organic Analysis			OBG Laboratories, Syracuse, New York
7.2 - Radiological Analysis			Teledyne Isotopes, Westwood, New Jersey
Task 8 - Data Analysis and Draft RI Report	90 days	7	O'Brien & Gere Engineers Inc., Edison, New Jersey
Task 9 - Final RI Report	30 days	Receipt of Comments on 8	O'Brien & Gere Engineers Inc., Edison, New Jersey

1) Working Days - excludes public holidays and weekends.

• TABLE 5. PRIMARY CONTACTS

<u>Name and Position</u>	<u>Organization and Address</u>	<u>Phone Number</u>
Mr. Kerwin Donato Southern New Jersey Compliance Section Site Compliance Branch USEPA, Region II	United States Environmental Protection Agency Region II 26 Federal Plaza New York, NY 10278	(212)264-5397
Mr. Stephen W. Holt Senior Environmental Engineer Environmental Control Dept.	NL Industries, Inc. P.O. Box 1090 Hightstown, NJ 08520	(609)443-2405
Mr. Frank D. Hale Research Manager	O'Brien & Gere Engineers, Inc. 1304 Buckley Road Syracuse, NY 13221	(315)451-4700

**Table 6**  
**QA/QC OBJECTIVES FOR WATER SAMPLES**  
**METALS**

CHEMICAL COMPOUND	METHOD	DETECTION LIMIT	AUDIT	FREQUENCY	CONTROL LIMITS
	*	ppb			
antimony	204.2	3	SEE BELOW	SEE BELOW	SEE BELOW
arsenic	206.2	1	"	"	"
beryllium	210.2	1	"	"	"
cadmium	213.2	1	"	"	"
chromium	218.2	1	"	"	"
copper	220.1	20	"	"	"
lead	239.2	1	"	"	"
mercury	245.1	0.2	"	"	"
nickel	249.1	40	"	"	"
selenium	270.2	2	"	"	"
silver	272.1	10	"	"	"
tin	282.1	800	"	"	"
thallium	279.2	1	"	"	"
zinc	289.1	10	"	"	"

\* Methods reference: EPA-600/4-79-020 Methods for chemical analysis of water and wastes.

AUDIT	FREQUENCY	CONTROL LIMITS
Calibration Verification	Calibrated daily and each time instrument is set up; verify at at a frequency of 10% or every 2 hr, whichever is greater.	Within $\pm 10\%$ of true value for all except tin and mercury ( $\pm 20\%$ of true value).
Calibration Blank	During calibration at a frequency of 10% during run and at end of run.	No more than detection limit.
Preparation Blank	1 per batch of samples digested or 1 in 20 whichever is greater	No more than detection limit.
Spiked Sample Analysis	1 per group of similar concentration and matrix, 1 per case of samples, or 1 in 20, whichever is greater.	Within $\pm 25\%$ recovery
Duplicate Sample Analysis	Same as spiked sample analysis.	$\pm 20\%$ RPD for values 5X detection limit or more, $\pm$ detection limit for samples less than 5X detection limit
Lab Control Sample (aqueous)	1 for each procedure for each case of samples received; 1 in 20 or 1 per batch digested, whichever is greater.	Within 80-120% recovery

Table 7  
QA/QC OBJECTIVES FOR WATER SAMPLES  
WET CHEMISTRY

CHEMICAL COMPOUND	METHOD	DETECTION LIMIT	AUDIT	FREQUENCY	CONTROL LIMITS
	*	ppb			
chlorides	325.2	1,000	SEE BELOW	SEE BELOW	SEE BELOW
cyanide	335.2	50	"	"	"
sulfate	375.3	10,000	"	"	"
total organic carbon	415.1	1000	"	"	"
total organic halides	450.1**	10	"	"	"

\* Methods Reference: EPA-600/4-79-020 "Methods for Chemical Analysis of Water and Waste Waters"

\*\* TOX method reference: U.S. EPA Office Of Research And Development, Environmental Monitoring And Support Laboratory, Physical And Chemical Methods Branch, Cincinnati, Ohio. November 1980.

AUDIT	FREQUENCY	CONTROL LIMITS
Calibration	calibrated daily and each time	Within $\pm 10\%$ of true value.
Verification	instrument is set up; verify at a frequency of 10% or every 2 hr whichever is greater.	
Calibration Blank	during calibration, at a fre- quency of 10% during run, and at end of run.	No more than detection limit
Duplicate Sample Analysis	1 per case of samples or 1 in 20, whichever is greater.	$\pm 20\%$ RPD for values 5X detection limit or more; $\pm$ detection limit for samples less than 5X detection limit.
Spiked Sample Analysis	1 per group of similar concen- tration, 1 per case of samples, or 1 in 20.	within $\pm 25\%$ recovery

Table 8  
QA/QC OBJECTIVES FOR GROUND WATER, SURFACE WATER,  
AND CONTAINED LIQUID SAMPLES  
RADIOLOGICAL CONSTITUENTS

CHEMICAL COMPOUND	METHOD	DETECTION LIMIT	AUDIT	FREQUENCY	CONTROL LIMITS
gross $\alpha$	See Exhibit C	See Exhibit C	See Exhibits B & C		
gross $\beta$	"	"	"	"	
radium isotopes	"	"	"	"	
uranium isotopes	"	"	"	"	
thorium isotopes	"	"	"	"	
potassium-40	"	"	"	"	
lead-210	"	"	"	"	

NOTE: The applicability of Teledyne's analytical procedure to determine gross  $\alpha$  and gross  $\beta$  activity in water was discussed with Mr Shawn Googins, U.S. EPA Region II Radiation Branch, 12 August 1987.

# TCL organics

Table 9  
QA/QC OBJECTIVES FOR GROUND WATER SAMPLES  
VOLATILE ORGANIC COMPOUNDS

CHEMICAL COMPOUND	METHOD	DETECTION LIMIT	AUDIT	FREQUENCY	CONTROL LIMITS
	*	ppb			
1,1,1-trichloroethane	WA 87-K236	5	**	**	**
1,1,2,2-tetrachloroethane	WA 87-K236	5	"	"	"
1,1,2-trichloroethane	WA 87-K236	5	"	"	"
1,1-dichloroethane	WA 87-K236	5	"	"	"
1,1-dichloroethene	WA 87-K236	5	"	"	"
1,2-dichloroethane	WA 87-K236	5	"	"	"
1,2-dichloropropane	WA 87-K236	5	"	"	"
1,3-dichloropropene	WA 87-K236	5	"	"	"
2-butanone	WA 87-K236	10	"	"	"
2-hexanone	WA 87-K236	10	"	"	"
4-methyl-2-pentanone	WA 87-K236	10	"	"	"
acetone	WA 87-K236	10	"	"	"
benzene	WA 87-K236	5	"	"	"
bromodichloromethane	WA 87-K236	5	"	"	"
bromoform	WA 87-K236	5	"	"	"
carbon tetrachloride	WA 87-K236	5	"	"	"
chlorobenzene	WA 87-K236	5	"	"	"
chloroethane	WA 87-K236	10	"	"	"
chloroform	WA 87-K236	5	"	"	"
dibromochloromethane	WA 87-K236	5	"	"	"
dichlorodifluoromethane	WA 87-K236	10	"	"	"
ethyl benzene	WA 87-K236	5	"	"	"
methyl bromide	WA 87-K236	10	"	"	"
methyl chloride	WA 87-K236	10	"	"	"
methylene chloride	WA 87-K236	5	"	"	"
styrene	WA 87-K236	5	"	"	"
t-1,2-dichloroethane	WA 87-K236	5	"	"	"
tetrachloroethene	WA 87-K236	5	"	"	"
toluene	WA 87-K236	5	"	"	"
trichloroethene	WA 87-K236	5	"	"	"
trichlorofluoromethane	WA 87-K236	10	"	"	"
vinyl acetate	WA 87-K236	10	"	"	"
vinyl chloride	WA 87-K236	10	"	"	"
xylenes (total)	WA 87-K236	5	"	"	"

\* Methods reference: U.S. EPA Contract Laboratory Program, Statement of work for multi-media multi-concentration IFB, WA 87-K236. October 1986. (Revised January, February, and July 1987.)

\*\* QA/QC requirements are specified in the above-referenced CLP statement of work.

Fancy name for 600 series

43-CFR-136

**Table 10**  
**QA/QC OBJECTIVES FOR GROUND WATER SAMPLES**  
**BASE/NEUTRAL AND ACID EXTRACTABLE COMPOUNDS**

CHEMICAL COMPOUND	METHOD	DETECTION LIMIT	AUDIT	FREQUENCY	CONTROL LIMITS
	*	ppb			
1,2,4-trichlorobenzene	WA 87-K236	10	**	**	**
1,2-diphenylhydrazine	WA 87-K236	10	"	"	"
1,2-dichlorobenzene	WA 87-K236	10	"	"	"
1,3-dichlorobenzene	WA 87-K236	10	"	"	"
1,4-dichlorobenzene	WA 87-K236	10	"	"	"
2,4,5-trichlorophenol	WA 87-K236	50	"	"	"
2,4,6-trichlorophenol	WA 87-K236	10	"	"	"
2,4-dichlorophenol	WA 87-K236	10	"	"	"
2,4-dimethylphenol	WA 87-K236	10	"	"	"
2,4-dinitrophenol	WA 87-K236	50	"	"	"
2,4-dinitrotoluene	WA 87-K236	10	"	"	"
2,6-dinitrotoluene	WA 87-K236	10	"	"	"
2-chloronaphthalene	WA 87-K236	10	"	"	"
2-chlorophenol	WA 87-K236	10	"	"	"
2-methylnaphthalene	WA 87-K236	10	"	"	"
2-methylphenol	WA 87-K236	10	"	"	"
2-nitroaniline	WA 87-K236	50	"	"	"
2-nitrophenol	WA 87-K236	10	"	"	"
3,3'-dichlorobenzidine	WA 87-K236	20	"	"	"
3-nitroaniline	WA 87-K236	50	"	"	"
4,6-dinitro-p-cresol	WA 87-K236	50	"	"	"
4-methylphenol	WA 87-K236	10	"	"	"
4-bromophenyl phenyl ether	WA 87-K236	10	"	"	"
4-chloroaniline	WA 87-K236	10	"	"	"
4-chlorophenyl phenyl ether	WA 87-K236	10	"	"	"
4-nitrophenol	WA 87-K236	50	"	"	"
4-nitroaniline	WA 87-K236	50	"	"	"
acenaphthylene	WA 87-K236	10	"	"	"
acenaphthene	WA 87-K236	10	"	"	"
anthracene	WA 87-K236	10	"	"	"
benzo(a)anthracene	WA 87-K236	10	"	"	"
benzo(a)pyrene	WA 87-K236	10	"	"	"
benzo(b)fluoranthene	WA 87-K236	10	"	"	"
benzo(g,h,i)perylene	WA 87-K236	10	"	"	"
benzo(k)fluoranthene	WA 87-K236	10	"	"	"
benzoic acid	WA 87-K236	50	"	"	"
benzyl alcohol	WA 87-K236	10	"	"	"
bis(2-chloroethoxy)methane	WA 87-K236	10	"	"	"
bis(2-chloroethyl) ether	WA 87-K236	10	"	"	"
bis(2-chloroisopropyl) ether	WA 87-K236	10	"	"	"
bis(2-ethylhexyl)phthalate	WA 87-K236	10	"	"	"
butyl benzyl phthalate	WA 87-K236	10	"	"	"
chrysene	WA 87-K236	10	"	"	"
di-n-butylphthalate	WA 87-K236	10	"	"	"
di-n-octyl phthalate	WA 87-K236	10	"	"	"
dibenzo(a,h)anthracene	WA 87-K236	10	"	"	"
dibenzofuran	WA 87-K236	10	"	"	"
diethyl phthalate	WA 87-K236	10	"	"	"
dimethyl phthalate	WA 87-K236	10	"	"	"
fluoranthene	WA 87-K236	10	"	"	"
fluorene	WA 87-K236	10	"	"	"
hexachlorobenzene	WA 87-K236	10	"	"	"
hexachlorobutadiene	WA 87-K236	10	"	"	"
hexachlorocyclopentadiene	WA 87-K236	10	"	"	"
hexachloroethane	WA 87-K236	10	"	"	"
indeno(1,2,3-c,d)pyrene	WA 87-K236	10	"	"	"
isophorone	WA 87-K236	10	"	"	"
N-nitrosodi-n-propylamine	WA 87-K236	10	"	"	"
N-nitrosodiphenylamine	WA 87-K236	10	"	"	"
naphthalene	WA 87-K236	10	"	"	"
nitrobenzene	WA 87-K236	10	"	"	"
p-chloro-m-cresol	WA 87-K236	10	"	"	"
pentachlorophenol	WA 87-K236	50	"	"	"



Table 10  
QA/QC OBJECTIVES FOR GROUND WATER SAMPLES  
BASE/NEUTRAL AND ACID EXTRACTABLE COMPOUNDS

CHEMICAL COMPOUND	METHOD	DETECTION LIMIT	AUDIT	FREQUENCY	CONTROL LIMITS
phenanthrene	WA 87-K236	10	"	"	"
phenol	WA 87-K236	10	"	"	"
pyrene	WA 87-K236	10	"	"	"

\* Methods reference: U.S. EPA Contract Laboratory Program, Statement of work for multi-media multi-concentration IFB, WA 87-K236. October 1986. (Revised January, February, and July 1987.)

\*\*QA/QC requirements are specified in the above-referenced CLP statement of work.

Table 11  
QA/QC OBJECTIVES FOR GROUND WATER SAMPLES  
PESTICIDES/PCBs

CHEMICAL COMPOUND	METHOD	DETECTION LIMIT	AUDIT	FREQUENCY	CONTROL LIMITS
	*	ppb			
4,4'-DDD	WA 87-K236	0.10	**	**	**
4,4'-DDE	WA 87-K236	0.10	"	"	"
4,4'-DDT	WA 87-K236	0.10	"	"	"
aldrin	WA 87-K236	0.05	"	"	"
Aroclor 1016	WA 87-K236	0.5	"	"	"
Aroclor 1221	WA 87-K236	0.5	"	"	"
Aroclor 1232	WA 87-K236	0.5	"	"	"
Aroclor 1242	WA 87-K236	0.5	"	"	"
Aroclor 1248	WA 87-K236	0.5	"	"	"
Aroclor 1254	WA 87-K236	1.0	"	"	"
Aroclor 1260	WA 87-K236	1.0	"	"	"
$\alpha$ -chlordane	WA 87-K236	0.5	"	"	"
$\gamma$ -chlordane	WA 87-K236	0.5	"	"	"
dieldrin	WA 87-K236	0.10	"	"	"
endosulfan I	WA 87-K236	0.05	"	"	"
endosulfan II	WA 87-K236	0.1	"	"	"
endosulfan sulfate	WA 87-K236	0.1	"	"	"
endrin	WA 87-K236	0.1	"	"	"
endrin ketone	WA 87-K236	0.1	"	"	"
heptachlor	WA 87-K236	0.05	"	"	"
heptachlor epoxide	WA 87-K236	0.05	"	"	"
methoxychlor	WA 87-K236	0.5	"	"	"
toxaphene	WA 87-K236	1.0	"	"	"
$\alpha$ -BHC	WA 87-K236	0.05	"	"	"
$\beta$ -BHC	WA 87-K236	0.05	"	"	"
$\gamma$ -BHC (lindane)	WA 87-K236	0.05	"	"	"
$\delta$ -BHC	WA 87-K236	0.05	"	"	"

\* Methods reference: U.S. EPA Contract Laboratory Program, Statement of work for multi-media multi-concentration IFB, WA 87-K236. October 1986. (Revised January, February, and July 1987.)

\*\*QA/QC requirements are specified in the above-referenced CLP statement of work.

**Table 12**  
**QA/QC OBJECTIVES FOR SOLID SAMPLES\***  
**METALS**

CHEMICAL COMPOUND	METHOD	DETECTION LIMIT	AUDIT	FREQUENCY	CONTROL LIMITS
		ppb**			
antimony	200.7 CLP-M, 7040	200	SEE BELOW	SEE BELOW	SEE BELOW
arsenic	7060	5	"	"	"
cadmium	200.7 CLP-M, 7130	10	"	"	"
chromium	200.7 CLP-M, 7190	50	"	"	"
copper	200.7 CLP-M, 7210	20	"	"	"
lead	200.7 CLP-M, 7420	100	"	"	"
selenium	7740	5	"	"	"
tin	200.7 CLP-M, 7870	800	"	"	"
zinc	200.7 CLP-M, 7950	10	"	"	"

\* Solid samples include soil, slag, equipment residue, containerized solids, and sediment.

\*\* The referenced detection limits refer to the digestates. Sample detection limits may vary depending on sample size.

+ Methods reference for AA methodologies: U.S. EPA, Test methods for evaluating solid waste, SW-846. November 1986. Samples will be digested using EPA Method 3050 for all parameters except mercury. The method to be used to digest mercury will be EPA Method 7471.

For ICP methodology: U.S. EPA Contract Laboratory Program, Statement Of Work For Inorganic Analysis, Multi-media Multi-concentration, SOW No. 787 (7/87).

AUDIT	FREQUENCY	CONTROL LIMITS
Calibration Verification	Calibrated daily and each time instrument is set up; verify at at a frequency of 10% or every 2 hr, whichever is greater.	Within $\pm 10\%$ of true value for all except tin and mercury ( $\pm 20\%$ of true value).
Calibration Blank	During calibration at a frequency of 10% during run and at end of run.	No more than detection limit.
Preparation Blank	1 per batch of samples digested or 1 in 20 whichever is greater	No more than detection limit.
Spiked Sample Analysis	1 per group of similar concentration and matrix, 1 per case of samples, or 1 in 20, whichever is greater.	Within $\pm 35\%$ recovery
Duplicate Sample Analysis	Same as spiked sample analysis.	$\pm 50\%$ RPD for values 5X detection limit or more, $\pm$ detection limit for samples less than 5X detection limit
Lab Control Sample	1 for each procedure for each case of samples received; 1 in 20 or 1 per batch digested whichever is greater.	Within 65 - 135% recovery.

**Table 13**  
**QA/QC OBJECTIVES FOR SOLID SAMPLES\***  
**EP TOXICITY METALS**

CHEMICAL COMPOUND	METHOD	DETECTION LIMIT	AUDIT	FREQUENCY	CONTROL LIMITS
	**	ppb			
arsenic	7060	5	SEE BELOW	SEE BELOW	SEE BELOW
barium	7080	100	"	"	"
cadmium	7130	10	"	"	"
chromium	7190	50	"	"	"
lead	7240	100	"	"	"
mercury (cold vapor)	7470	0.2	"	"	"
selenium	7740	5	"	"	"
silver	7760	10	"	"	"

\* Solid samples include soil, slag, equipment residue, containerized solids, and sediment.

\*\* Methods reference: U.S. EPA, Test methods for evaluating solid waste. SW-846. November 1986.

EP Toxicity Extraction Procedure: Method 1310, Test Methods For Evaluating Solid Waste, SW 846, Nov. 1986.

AUDIT	FREQUENCY	CONTROL LIMITS
Calibration Verification	Calibrated daily and each time instrument is set up; verify at at a frequency of 10% or every 2 hr, whichever is greater.	Within $\pm 10\%$ of true value for all except tin and mercury ( $\pm 20\%$ of true value).
Calibration Blank	During calibration at a frequency of 10% during run and at end of run.	No more than detection limit.
Preparation Blank	1 per batch of samples extracted or 1 in 20, whichever is greater	No more than detection limit
Spiked Sample Analysis	1 per group of similar concentration and matrix, 1 per case of samples, or 1 in 20, whichever is greater.	Within $\pm 25\%$ recovery
Duplicate Sample Analysis	Same as spiked sample analysis.	$\pm 50\%$ RPD for values 5X detection limit or more; $\pm$ detection limit for samples less than 5X detection limit
Lab Control Sample (soils)	once a month for each of the procedures (applied) to solid sample analysis.	Within 65 - 135% recovery.

**TABLE 14**  
**EMERGENCY RESPONSE ORGANIZATIONS AND CONTACTS**

NEW JERSEY STATE POLICE -	609-769-0774
LOCAL FIRE DEPT. -	609-935-4505
LOCAL AMBULANCE -	609-935-4505
HOSPITAL: Salem Co. Memorial Hospital -	609-935-1000
Underwood-Memorial Hospital -	Emergency 609-853-2000
North Broad & West Red Bank Ave -	Administration Number
Woodbury, New Jersey	609-845-0100
POISON CONTROL CENTER	- 1-800-962-1253
NATIONAL RESPONSE CENTER	- 1-800-424-8802 (24-hr)
CHEMTREC	- 1-800-424-9300 (24-hr)
NJDEP Environmental Emergency 24-hour Action Line	- 609-292-7172
NL: Mr. Stephen W. Holt	- 609-443-2405
OB&G: Mr. Frank D. Hale	- 315-451-4700

# Figures



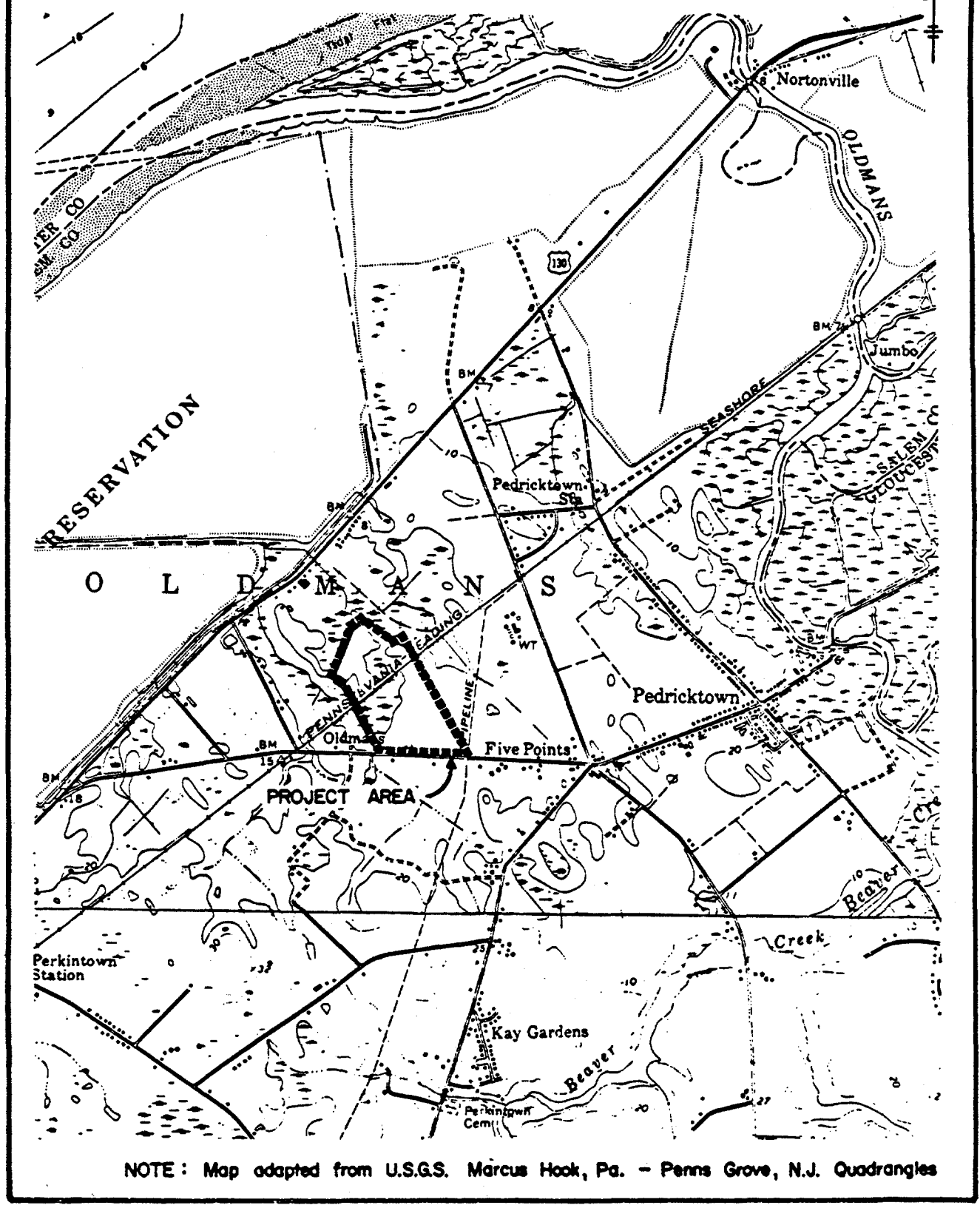
**OBRIEN & GERE**

NLI 001 0635

FIGURE I

# NL INDUSTRIES, INC. PEDRICKTOWN, NEW JERSEY

## PROJECT LOCATION MAP



NOTE: Map adapted from U.S.G.S. Marcus Hook, Pa. - Penns Grove, N.J. Quadrangles

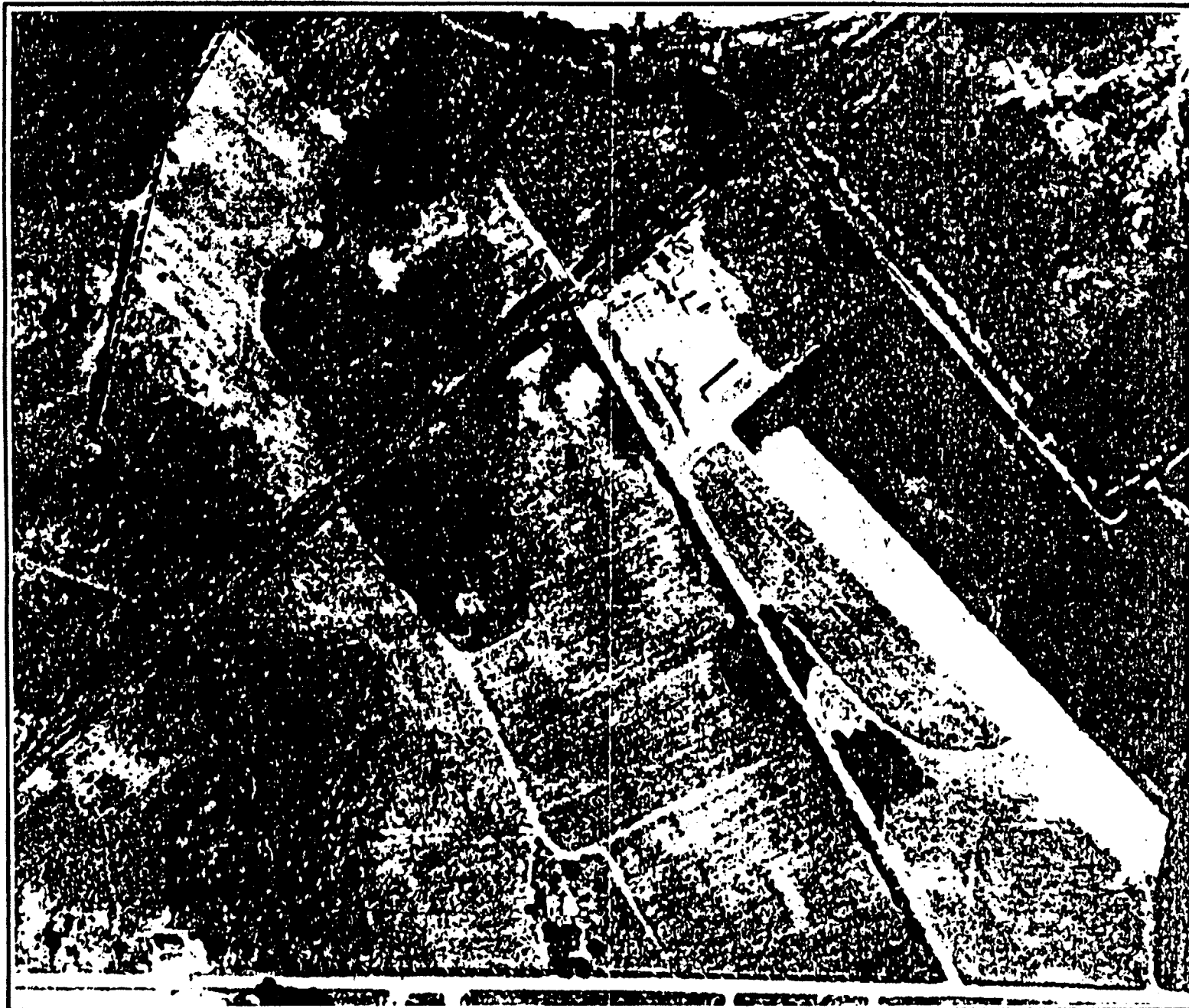


FIGURE 2



NL INDUSTRIES, INC.

NATIONAL SMELTING  
OF NEW JERSEY  
PEDRICKTOWN, NEW JERSEY

1970  
AERIAL PHOTOGRAPH

SCALE IN FEET





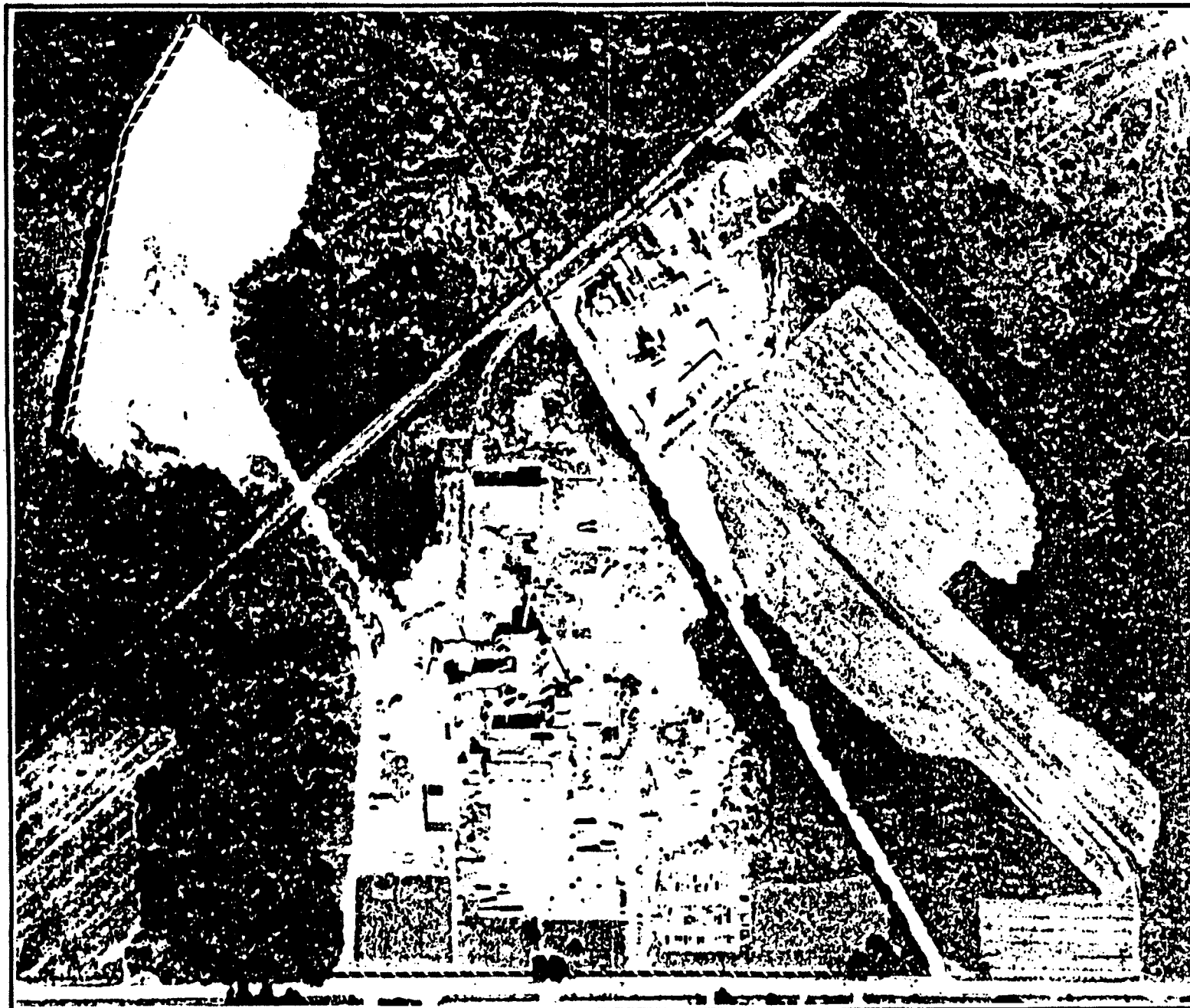


FIGURE 3



NL INDUSTRIES, INC.

NATIONAL SMELTING  
OF NEW JERSEY  
PEDRICKTOWN, NEW JERSEY

1978  
AERIAL PHOTOGRAPH

SCALE IN FEET

200 0 200  
1" = 200'

 GLOBE

NLI 001 0638

**EPA REGION II**  
**SCANNING TRACKING SHEET**

DOC ID # 54373

DOC TITLE/SUBJECT:

**FIGURE 4**

**1982**

**AERIAL PHOTOGRAPH**

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LOCATED IN THE ADMINISTRATIVE RECORD FILE  
AT THE

**SUPERFUND RECORDS CENTER**  
**290 BROADWAY, 18<sup>TH</sup> FLOOR**  
**NEW YORK, NY 10007**

**EPA REGION II**  
**SCANNING TRACKING SHEET**

DOC ID # 54373

DOC TITLE/SUBJECT:  
**FIGURE 7**

**WELL LOCATION MAP**

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LOCATED IN THE ADMINISTRATIVE RECORD FILE  
AT THE

**SUPERFUND RECORDS CENTER**  
290 BROADWAY, 18<sup>TH</sup> FLOOR  
NEW YORK, NY 10007

**FIGURE 8**

**O'BRIEN & GERE**

## CHAIN OF CUSTODY RECORD

SURVEY						SAMPLERS: (Signature)						
STATION NUMBER	STATION LOCATION	DATE	TIME	SAMPLE TYPE			SEQ. NO.	NO. OF CONTAINERS	ANALYSIS REQUIRED			
				Water		Air						
				Cong.	Gra.							
Relinquished by: (Signature)				Received by: (Signature)					Date/Time			
Relinquished by: (Signature)				Received by: (Signature)					Date/Time			
Relinquished by: (Signature)				Received by: (Signature)					Date/Time			
Relinquished by: (Signature)				Received by Mobile Laboratory for field analysis: (Signature)					Date/Time			
Dispatched by: (Signature)		Date/Time		Received for Laboratory by:				Date/Time				
Method of Shipment:												

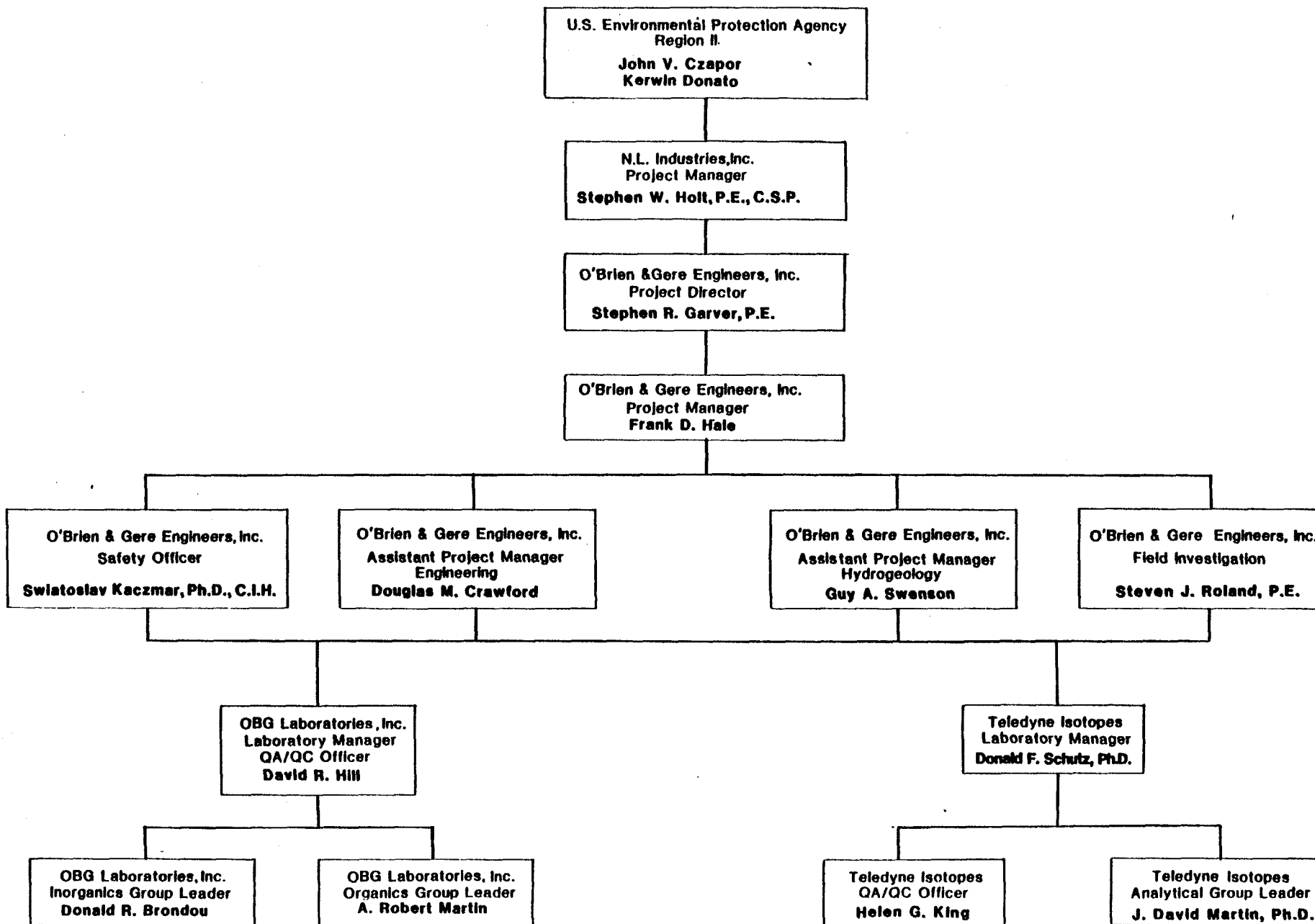


FIGURE 9

## SAMPLING SITE DESCRIPTION FORM

PROJECT: \_\_\_\_\_ DATE: \_\_\_\_\_

SAMPLER: \_\_\_\_\_

SITE ADDRESS: (STREET, NUMBER, COORDINATES) \_\_\_\_\_

TYPE OF SITE: (RESIDENTIAL, INDUSTRIAL, ETC.) \_\_\_\_\_

PROPERTY OWNER: \_\_\_\_\_

LOCATION OF SAMPLING: (BACKYARD, PARK, ETC.) \_\_\_\_\_

SKETCH MAP OF THE SAMPLING AREA AND ATTACH IT TO THIS FORM

ADJOINING PROPERTY: (RESIDENTIAL, INDUSTRIAL, ETC.) \_\_\_\_\_

GROUND SURFACE: (BARE, LAWN, ETC.) \_\_\_\_\_

STRUCTURAL ODDITIES: (SWIMMING POOLS, SHEDS, ETC.) \_\_\_\_\_

TYPE OF SAMPLING PERFORMED: (SOIL, DUST, ETC.) \_\_\_\_\_

SAMPLE COLLECTION TAG NUMBERS: \_\_\_\_\_

CONDITION OF SAMPLING SITE: (DEBRIS, RESIDUES, STANDING WATER, ET

REMARKS: (INCLUDING ALL SAMPLE NUMBERS) \_\_\_\_\_

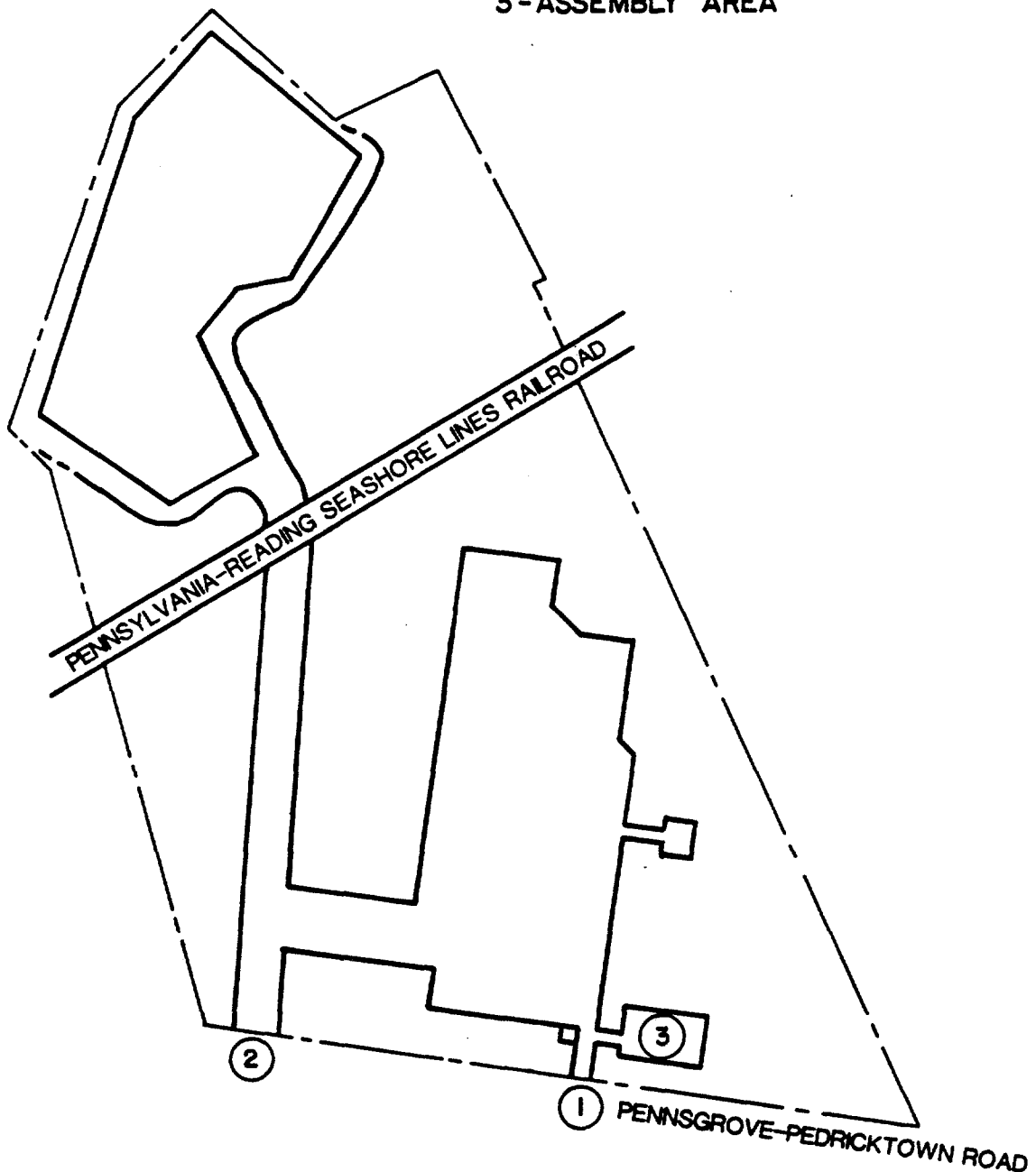
FIGURE 11

NL INDUSTRIES, INC.  
PEDRICKTOWN, NEW JERSEY

SITE CONTROL POINTS



- 1- PRIMARY SITE ENTRANCE & EXIT
- 2- SECONDARY (EMERGENCY) SITE ENTRANCE & EXIT
- 3- ASSEMBLY AREA



NLI 001 0644

# Appendices



**O'BRIEN & GERE**

NLI 001 0645



APPENDIX A  
RADIATION SURVEY PROTOCOL

## RADIATION SURVEY PROTOCOL

The radiation survey will involve the measurement of total ionizing radiation (i.e., alpha particles, beta particles, and gamma rays with a radiation survey meter. Radiation measurements are to be taken at each waste sampling location and at a number of intermediate locations. The waste sampling locations will include:

- Warehouse
- Refining building
- Iron and coke bins
- Battery bins
- Slag bins
- Ponds on asphalt pavement at east end of plant area
- Ponds on concrete pavement in center of plant area
- Acid pit
- Acid tanks
- Thickener pit
- Thickener tank
- Wastewater tanks
- Effluent tanks
- Landfill leachate sumps
- Office

The intermediate locations shall include several locations at the property boundaries. All measurements shall be recorded on a site description form (see Figure 10) maintained in a field log book. If a radiation level equal to or greater than 2 mR/hr is observed, the survey crew shall record the observation and leave the site immediately. The appropriate project personnel are to be contacted within 24 hours as practicable to discuss the impact of elevated radiation levels on future project activities.

A Ludlum Measurements, Inc. Model 3 Radiation Survey Meter with a Model 44-9 detector shall be utilized. The manufacturer's instructions shall be maintained with the equipment and adhered to regarding use of the radiation detector by O'Brien & Gere Engineers.

APPENDIX B  
SAMPLING EQUIPMENT  
AND  
DECONTAMINATION PROTOCOL

NL PEDRICKTOWN  
SAMPLING EQUIPMENT  
ROUND 1 SAMPLING

SAMPLING EQUIPMENT:

SITE IDENTIFICATION:

2"x2"x24" wooden stakes  
orange spray paint  
hammer  
labels

HYDROGEOLOGIC INVESTIGATION:

waders  
disposable pipettes  
2" submersible pump  
peristaltic pump  
stainless steel or teflon hand bailer  
hand vacuum pump  
tygon tubing  
250 ml flask with silicon stopper  
1000 ml vacuum flask  
heavy duty plastic vacuum tubing  
large capacity manual vacuum pump  
water filtering apparatus  
filters (45 micron)  
100 ft steel tape  
6 ft rule  
electrical cord  
glass funnel  
plastic sheeting  
polypropylene rope  
silicone spray  
flagging tape  
electrical tape  
aluminum foil  
tool kit: phillipshead screwdrivers  
wrenches  
hammers  
knife  
pliers  
tubing cutter  
hacksaw  
water level probe  
well opening tools (keys)  
duct tape  
hose clamps  
nitric acid

Sampling Containers:

500 ml plastic capped jars, preserved w/HNO3  
500 ml plastic capped jars, preserved w/NaOH  
500 ml glass jars w/teflon-lined tops, preserved w/ HNO3

TOC bottles preserved w/HNO3  
TOH bottles preserved w/HCl w/teflon-lined tops  
TOH bottles w/teflon-lined tops  
1 gallon plastic bottles, preserved w/HNO3

SOIL AND SEDIMENT INVESTIGATION:

3/4" ID, 1/8" thickness Lexan core  
Wildco hand operated core sampler  
aluminum pans  
large stainless steel spoon  
polypropylene scoops  
aluminum scoops  
disposable spatulas  
shovel  
sampling trier  
hand auger  
split barrel sampler  
scalpel and blades  
wooden dowel

Sampling Containers:

27 ounce sterile whirl-pak polyethylene bags  
ziploc bags  
12" x 30" plastic bags  
500 ml glass jars w/teflon-lined caps, preserved w/ HNO3

STORED MATERIALS INVESTIGATION:

bung wrench  
disposable glass coliwasa samplers

Sampling Containers:

500 ml glass jars w/teflon-lined caps, preserved w/ HNO3  
TOC bottles preserved w/HNO3  
TOC bottles preserved w/H2SO4  
TOX bottles w/teflon-lined tops  
containers for gross alpha & beta analysis

PLANT-WIDE RADIATION INVESTIGATION:

radiation survey meter

GENERAL:

pH meters  
specific conductance meters  
surveying equipment  
disposable gloves  
disposable shoe covers  
plastic disposal bags  
paper towels  
fire extinguishers  
pressurized hand sprayer  
whistle  
plastic garbage cans  
scissors

HANDLING, STORAGE, AND SHIPPING:

coolers

ice  
ice packs  
shipping labels  
markers

DOCUMENTATION:

field notebooks  
sample tags  
field record forms  
chain-of-custody records  
35mm camera  
35 mm, color slide film

QA/QC:

field blanks: diatomaceous earth, and distilled water  
duplicate samples  
split samples

SAFETY EQUIPMENT:

---

GENERAL PERSONAL EQUIPMENT:

respirator (full-face and/or half-face);  
high efficiency dust, mist, radionuclide  
filter; acid gases/vapor cartridge  
rubber safety boots or safety workboots with rubber  
overboots  
cotton overalls or work clothing under white tyvek(R)  
suit  
tyvek(R) or other hood  
cotton gloves or surgeon's gloves with rubber  
overgloves  
protective eyewear  
hard hat (during drilling)  
noise protection (during drilling)  
first aid kit and manual

DECONTAMINATION:

brushes  
tub  
hydrochloric acid  
distilled water  
55 gallon drums  
interference-free, redistilled solvent (eg acetone  
or methyl chloride)  
detergent  
5 gallon pails  
garden hose

All field sampling equipment making contact with samples targeted for chemical analyses will be decontaminated before each use as follows:

- a. Non-phosphate detergent and tap water wash
- b. Tap water rinse
- c. 10% nitric acid rinse
- d. Tap water rinse
- e. Acetone rinse or methanol followed by hexane rinse
- f. Distilled/deionized water rinse
- g. Air dry
- h. Wrap in aluminum foil (shiny side out) for transport

Procedure e. will be deleted where organic analyses are not to be performed on samples. Distilled/deionized water will be provided by ORG Laboratories as part of the QA/QC program.

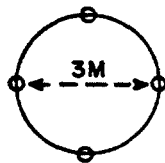
APPENDIX C  
SOIL SAMPLING PROTOCOL



## SOIL SAMPLING PROTOCOL

### General

Samples will be obtained by compositing subsamples collected from four equally spaced locations on the arc of the three meter circle. One subsample will be collected from the northernmost point of the circle, one from the southernmost point, one from the easternmost point, and one from the westernmost point (as illustrated below).



•subsample collection point

Disposable 3/4-inch diameter Lexan<sup>R</sup> cores shall be used to obtain the subsamples. The composite sample for a given depth and location will consist of all four subsamples obtained at the same depth, and placed in the same sample container.

The field sampling team will be responsible for adhering to the following sampling guidelines:

- a. Avoid, if possible, collecting samples that are less than 20 feet from painted surfaces;
- b. Locate collection sites as far as possible from vehicle activity such as streets, driveways, parking lots, and automobile repair areas;
- c. Avoid, if possible, collecting samples under or immediately adjacent to trees, shrubs, and/or structures;
- d. A new piece of Lexan<sup>R</sup> will be used for collecting subsamples at each location and;
- e. Chain of custody procedures will be consistent with those outlined in the Sampling Plan.

### Sampling Procedures

Soil samples are to be obtained utilizing the following procedures:

- a. Identify the sample location;
- b. Identify the subsample locations on a 3-meter diameter circle using a compass;
- c. Complete a site description form, presented as Figure 10;
- d. Put on a new pair of disposable gloves;

- e. At each subsample location, hand-drive a new Lexan<sup>R</sup> core to the desired depth;
- f. Withdraw Lexan<sup>R</sup> core;
- g. Cap ends of Lexan<sup>R</sup> core with plastic end caps;
- h. Label each subsample;
- i. Place Lexan<sup>R</sup> cores with subsamples from a given depth in a 27-ounce whirl-pak polyethylene container;
- j. Complete steps d through i above for each desired depth.
- k. The samples are to be stored at ambient conditions in a covered container.
- l. Should rejection at any depth be encountered, the sample location will be relocated and all depths will be resampled. A carbon steel or stainless steel shovel or towel will be used when necessary, to obtain required depths for soil sampling.

#### Compositing Procedures

The subsamples are to be extruded and composited under controlled ambient conditions, such as a laboratory. The following procedures will be followed in compositing samples:

- a. Put on a new pair of disposable gloves;
- b. Using a clean wooden dowel or other suitable instrument, extrude each subsample into an aluminum foil-lined pan;
- c. Samples are to consist of mineral soil only. Remove any vegetative material (e.g., grass, roots) by dissection;
- d. Manually mix the subsamples together;
- e. Place the entire composite sample into a labelled glass jar from CLP source.

The sample containers are to be stored in a closed container to minimize atmosphere contamination. The samples are to be stored at ambient conditions and archived for at least 120 days after submission of the RI Report.

APPENDIX D  
SLAG AND EQUIPMENT RESIDUE SAMPLING PROTOCOL

## SLAG AND EQUIPMENT RESIDUE SAMPLING PROTOCOL

The slag and equipment residue samples for metals analyses shall be collected using the following grab sampling procedures:

- a. Identify the sampling location;
- b. Complete a site description form, presented as Figure 10;
- c. Put on a new pair of disposable gloves;
- d. Using a carbon steel or stainless steel shovel, trowel, or other suitable sampling instrument, obtain a representative portion (at least approximately 200 grams) of the material being sampled. Lexan<sup>®</sup> tubing may also be used.
- e. Place the sample in a labelled, sterile 27-ounce whirl-pak polyethylene container;
- f. The samples are to be stored at ambient conditions in a covered container;
- g. Decontaminate the sampling instruments between samples as noted in Appendix B.

APPENDIX E  
DRUM SAMPLING PROTOCOL

## DRUM SAMPLING PROTOCOL

### Drum Sampling Protocol

The procedure presented below, which are consistent with the procedures for sampling liquid and solid drummed wastes outlined in "Samplers and Sampling Procedures for Hazardous Waste Streams" (EPA-600/2-80-018). These procedures may need to be altered based on field conditions at the time of sampling.

#### General Drum Sampling

1. Identify the drum and record the location in the field sampling notebook.
2. Put on a new pair of disposable gloves.
3. Position the drum to be sampled such that the bung is up. Drums with the bung on the end should be positioned upright. Those with the bung on the side should be positioned on a side with the bung up.
4. Allow sufficient time for the drum contents to settle.
5. Loosen the bung slowly with a bung wrench, allowing any pressure to be released.
6. Remove the bung.
7. Classify the contents of the drum as liquid or solid and sample the contents accordingly, as outlined below.

#### Sampling Drummed Liquids Wastes

1. Sample will be obtained with a Coliwasa or disposable glass tubing sampler. Check the sampler to make sure it is functioning properly.
2. Put the sampler in the open position.

3. Lower the sampler slowly into the liquid waste, assuring that the levels of the liquid inside and outside the sampler tube are approximately the same.
4. When the sampler stopper reaches the bottom of the drum, push the sampler tube downward against the stopper to close the sampler. Lock the sampler closed.
5. Withdraw the sampler slowly from the drum with one hand while wiping the sampler tube with a disposable cloth with the other hand.
6. Discharge the sample into a 2 liter widemouth glass sample bottle by slowly opening the sampler. Pour an aliquot into a 100 ml beaker and measure the pH and conductivity of the sample. Return the 100 ml aliquot to the drum. Cap the sample bottle.
7. Begin the Chain-of-Custody Record.
8. Replace the bung.
9. Decontaminate the sampler in accordance with the General Decontamination Procedures presented in Appendix B.
10. Place the gloves, rags, and other contaminated materials in a plastic bag for disposal.

#### Sampling Drummed Solid Wastes

1. Sample will be obtained with a sample trier, or other appropriate sampler constructed of carbon steel or stainless steel.
2. Insert the trier into the waste at a 0 to 45 deg. angle from horizontal.
3. Rotate the trier once or twice to cut a core of the waste.
4. Withdraw the trier slowly, making sure the slot is facing upward.

5. Transfer the sample into a 1 pint widemouth glass sample bottle using a brush or spatula. Cap the sample bottle.
6. Begin the Chain-of-Custody Record.
7. Replace the bung.
8. Decontaminate the sample trier in accordance with the General Decontamination Procedures presented in Appendix B.
9. Place the gloves, rags, and other contaminated materials in a plastic bag for disposal.



APPENDIX F  
CONTAINED LIQUID SAMPLING PROTOCOL

### CONTAINED LIQUID SAMPLING PROTOCOL

For contained liquid depths of three feet or less, samples will be obtained utilizing the drum sampling procedures detailed in Appendix E.

For contained liquid depths of greater than three feet, samples will be obtained utilizing the following procedures;

- a. identify sampling location;
- b. Complete a site description form, presented as Figure 10;
- c. Put on a new pair of disposable gloves;
- d. Lower a clean stainless steel and teflon Kemmerer<sup>R</sup> sampler or equivalent to approximately one-inch below the surface of the liquid;
- e. Pour off a known volume of liquid into the appropriate labelled, clean sample container(s);
- f. Repeat steps d and e at the mid-depth and bottom of the container, ensuring that the same volume of liquid is placed in the sample container each time.
- g. Preserve the sample as necessary;
- h. Store samples at 4°C in a covered container.
- i. Decontaminate sampler as noted in Appendix B.

APPENDIX G  
SURFACE WATER SAMPLING PROTOCOL

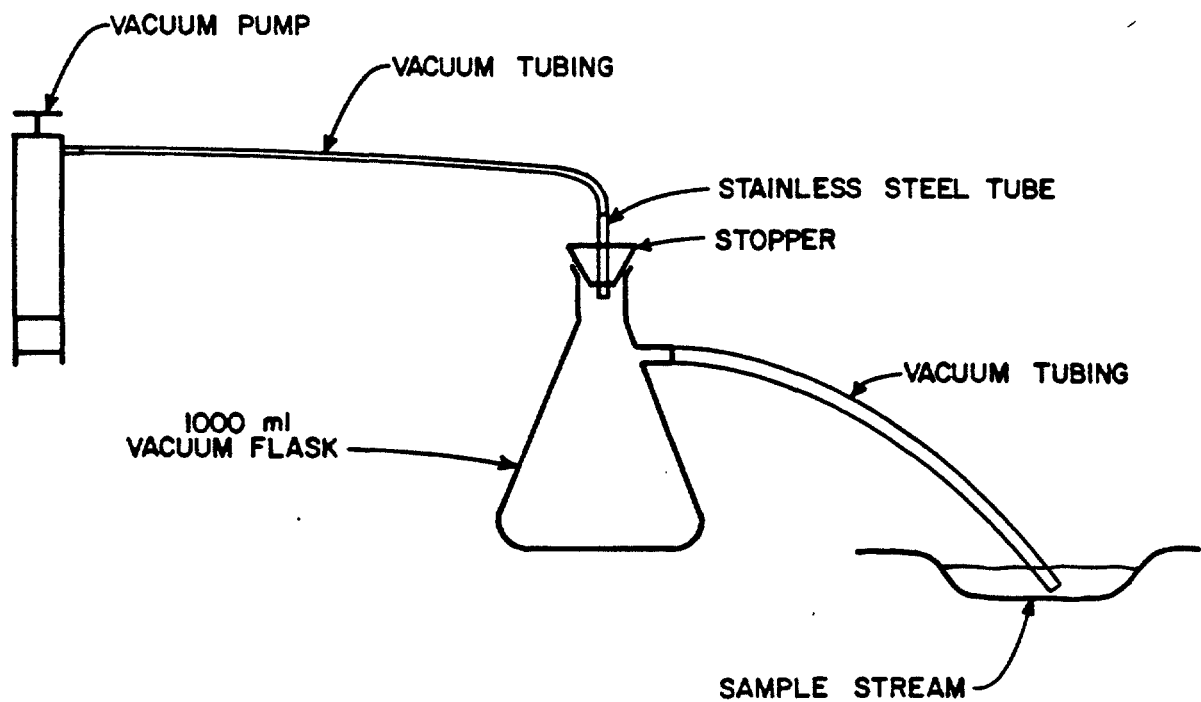
## SURFACE WATER SAMPLING PROTOCOL

Surface water samples will be collected using the collection device illustrated in the attached figure. Surface water samples will be obtained utilizing the following procedures:

- a. Identify sampling location;
- b. Complete a site description form, presented as Figure 10.
- c. Put on a new pair of disposable gloves;
- d. Firmly insert a clean stopper with stainless steel tube into the neck of a clean 1,000 ml vacuum flask;
- e. Attach a length of new suction tubing to the side arm of the flask for sample collection;
- f. Attach vacuum pump to the stainless steel tube with vacuum tubing;
- g. Lower the polyethylene or polypropylene suction tubing approximately one inch below the water surface at the approximate middle of the channel, taking care not to disturb and suspend sediments;
- h. Activate the vacuum pump until sufficient volume has been collected in the flask; do not fill to top;
- i. Upon collection of the samples transfer to the sample containers with appropriate preservatives. If a container with preservative is overfilled, the container will be discarded and the sample will be transferred to a new sample container with appropriate preservatives.
- j. Store sample containers at 4°C in a covered container.
- k. Initiate chain-of-custody procedures;
- l. Discard suction tubing in a labelled container and store for proper disposal;

m. Decontaminate sampling equipment in accordance with  
- Appendix B.

# SURFACE WATER SAMPLING INSTRUMENT

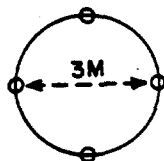


APPENDIX H  
SEDIMENT SAMPLING PROTOCOL

## SEDIMENT SAMPLING PROTOCOL

### General

In general, two types of surface water sediment are likely to be encountered. One type of sediment consists of relatively fine-grained material that tends to be cohesive (e.g., silt, clay), whereas the other type is characterized by larger-grained, non-cohesive materials (e.g., gravel). Since the two types of sediments exhibit different physical characteristics, the methods required to obtain a representative sample of each are different. The field sampling team is responsible for deciding which sampling procedure to use, based on the nature of the materials encountered. The two sampling procedures are presented below. In both procedures, each sample is a composite of several subsamples. In the case of stream sediments, three subsamples will be collected, one from the approximate middle of the stream cross-section, and the other two equally spaced on each side. When marsh sediments are being sampled, four subsamples will be collected from four equally spaced locations on the arc of a three meter circle. One subsample will be located at the northernmost point of the arc, one at the southernmost point, one at the easternmost point, and one at the westernmost point (as illustrated below).



°subsample collection point

Chain of custody procedures will be consistent with those outlined in the Sampling Plan.

### Sampling Procedures

The following procedures are to be utilized where the sediments to be sampled are relatively fine-grained and cohesive:

- a. Identify the sample location;
- b. Identify the subsample locations;
- c. Complete a site description form, presented as Figure 10;
- d. Put on a new pair of disposable gloves;
- e. At each subsample location, hand-drive a new two-inch Lexan<sup>R</sup> core to the desired depth, record depth;
- f. Withdraw Lexan<sup>R</sup> core, record recovered depth;
- g. Cap ends of Lexan<sup>R</sup> core with plastic end caps;
- h. Label each subsample;
- i. Freeze sample in a vertical position with dry ice



- j. Place Lexan<sup>R</sup> cores with subsamples from a given depth in a sterile whirl-pak polyethylene container;
- k. Store samples in a closed container at less than 0°C.

Upon arrival at the analytical laboratory, the frozen cores will be cut to select the desired depth for compositing and subsequent analysis. Once the desired depths have been cut, they are to be extruded from the Lexan<sup>R</sup> core using a clean wooden dowel or other suitable instrument, into an aluminum foil-lined pan. The subsamples should be allowed to thaw. Any vegetative material present in the subsamples is to be removed by dissection. The subsamples are then manually mixed and placed into a labelled glass container provided by a CLP supplier. Store the composite samples in a closed container at ambient conditions.

The following procedure is to be utilized when sampling larger-grained, non-cohesive sediments.

- a. Identify the sample location;
- b. Identify the subsample locations;
- c. Complete a site description form, presented as Figure 10.
- d. Put on a new pair of disposable gloves;
- e. At each subsample location, use a carbon steel or stainless steel small shovel, trowel, or other appropriate grab sampling instrument to obtain subsamples;
- f. Place a representative portion (at least 50 grams) of the subsample in a labelled glass container provided by a CLP supplier.
- g. Repeat steps e and f for all subsamples;
- h. Store subsamples in a closed container at ambient conditions;
- i. decontaminate the sampling instrument using protocols defined in Appendix B.

The subsamples are to be composited under controlled ambient conditions (e.g. in a laboratory). To composite the subsamples, put on new disposable gloves, open the appropriate subsample containers, and place an approximately equal amount (at least 50 grams) of each subsample into an aluminum foil-lined pan. Remove any vegetative material present by dissection. Manually mix the subsamples together, and place the entire composite sample into a labelled, glass container provided by a CLP supplier. Store the composite samples in a closed container at ambient conditions.

APPENDIX I  
GROUND WATER SAMPLING PROTOCOL

## GROUND WATER SAMPLING PROCEDURES

### I. MATERIALS

1. Plastic sheeting (10 ft by 10 ft minimum) - polyethylene
2. Bailer (bottom filling) 1-1/2 inch I.D. stainless steel
3. Decontaminated monofilament polypropylene, stainless steel wire or teflon coated wire.
4. Distilled water
5. Dilute (0.1 N) hydrochloric acid
6. Clean disposable towels
7. Well depth probe
8. 100' cloth tape
9. Submersible pump with accessories
10. Rinsing basins
11. Graduated pail
12. Conductivity meter
13. pH meter
14. Temperature meter
15. Appropriate sampling containers
16. 200 ml beaker
17. Insulated transport containers
18. HNU photoionization detector
19. Polyethylene tubing
20. Surface pump with accessories

## II. GENERAL NOTES

The following general notes and subsequent procedural outlines must be adhered to during all well developing and sampling operations:

1. The site Health and Safety Plan must be adhered to at all times.
2. Sampling of monitoring wells will be discontinued during precipitation periods (rain or snow).

## III. MONITORING WELL PROCEDURES

Sampling procedures for bailing and pumping are explained in detail below.

### A. Preliminary Procedures

1. Identify the well and record the location on the Ground Water Sampling Field Log.
2. Put on a new pair of disposable gloves.
3. Cut a slit in the center of the plastic sheet, and slip it over the well creating a clean surface onto which the sampling equipment can be positioned. This clean working area should be a minimum of 10 feet by 10 feet.
4. Clean all meters, tools, equipment, etc., before placing on the plastic sheet.
5. Disposable shoe covers should be placed over the samplers shoes to prevent potential contamination from dirty shoes contacting the plastic sheet. Do not kick, transfer, drop, or in any way let soils or other materials fall onto this plastic sheet unless it comes from inside the well.

6. Clean the well cap with a clean towel, and remove the well cap, and plug placing both on the plastic sheet.
7. Sample the air in the well head for organic vapors using a HNU P101 photoionization detector. Record the results.
8. Using an electric well probe, measure the depth to the water table and the bottom of the well. Record this information to the nearest 0.01 foot in the Ground Water Sampling Field Log.
9. Clean the well depth probe with a non phosphate detergent/soap mixture and rinse it with distilled water after use.
10. Lower a clean bailer to submerge it only enough to fill one half full. Recover bailer and pour liquid in a clean glass container. Record appearance.
11. Decontaminate the bailer in accordance with Appendix B. The rope or wire will be dedicated to individual wells.
12. Compute the volume of water in the well, and record this volume on the Ground Water Sampling Field Log.

**B1. Evacuation (Surface Pump)**

1. Install a measured length of tubing into the well such that it is just below the water table. Once installed, the tubing is left in the well permanently.

2. The top of the tubing is connected to a one gallon sampling container by pushing it through a silicone stopper and connected to a suction source with a piece of tubing.
3. Use a vacuum source to draw water up through the tubing, through the one gallon sample container. Remove three times the well volume of water in the well or until the well is pumped dry. If the well is pumped dry, allow sufficient time for the well to recover before sampling. If the well does not go dry proceed directly to sampling by method C1.

B2. Evacuation Procedure (Submersible Pump)

1. Prepare the submersible pump for operation.
2. Lower the pump to just beneath the water table and pump the ground water at a rate not to exceed 2 gallons per minute into a graduated container. Pumping should continue until three well volumes have been removed or the well is pumped dry. If the well is pumped dry, sampling will occur as soon as the ground water elevation returns to the initial ground water elevation. The objective will be to complete this within three hours, however, hydrogeologic conditions may not permit this. Record this information on the Ground Water Sampling Field Log. Once this purging process is completed, care should be taken not to further agitate the water in the well. If volatile organic analyses are to be conducted

then vials should be filled within three hours of evacuation, when possible, or when there is sufficient volume to fill volatile vials.

C1. Sampling Procedure (Bailer)

1. Slowly remove the evacuation pump, if used, decontaminant, and place in clean container.
2. Remove the sampling bottles from their transport containers, and prepare the bottles for receiving samples. Inspect all labels to insure proper sample identification. Sample bottles should be kept cool with their caps on until they are ready to receive samples. Arrange the sampling containers to allow for convenient filling. Fill the containers in the following order: Volatile organics, TOX, TOC, extractable organics, total metals, dissolved metals, phenols, sulfate/chloride, turbidity, and radionuclides.
3. Samples for filtered metals analyses will be filtered in the field as soon as practicable after water removal from the well. Assemble the 0.45 micron filter apparatus and seat cellulose ester filter with deionized water. Filter the necessary volume of sample. Decontaminate filter apparatus in accordance with Appendix B. Place clean filter apparatus in a clean plastic bag.
4. To minimize agitation of the water in the well, initiate sampling by lowering the bailer slowly into the well making certain to submerge it only far enough to fill it completely.

5. Slowly remove bailer from well to prevent surging. Avoid contact between line and external protective casing of the well.
6. Slowly fill each sample container. Return each sample bottle to its proper transport container. If the sample bottle cannot be filled quickly, keep them cool with the caps on until they are filled. The vials labeled purgeable priority pollutant analysis should be filled from one bailer without headspace then securely capped. If a container with preservative is overfilled, the container will be discarded and the sample will be transferred to a new sample container with appropriate preservatives.

NOTE: Samples must not be allowed to freeze.

7. Record the physical appearance of the ground water observed during sampling on the Ground Water Sampling Field Log.
8. After the last sample has been collected, record the data and time, and empty one bailer of water from the surface of the water in the well into the 200 ml beaker and measure and record the pH, conductivity and temperature of the ground water following the procedures outlined in the equipment operation manuals. Record this information on the Ground Water Sampling Field Log. The 200 ml beaker must then be washed with a non phosphate detergent/soap mixture followed by a dilute (0.1N) nitric acid rinse and distilled water rinse prior to reuse.



9. Begin the Chain of Custody Record. A separate form is required for each well with the required analysis listed individually.
10. Replace the well plug, and lock the well protection assembly before leaving the well location.
11. Place the gloves, rags, and plastic sheeting into a plastic bag for disposal.
12. Clean the bailer in accordance with Appendix B.

#### IV. RESIDENTIAL WELL PROCEDURES

1. Obtain the well depth, casing, size, and holding tank volume. Calculated the volume of water in the system as follows: Well volume (gallons) = (area of well casing in square feet) (feet of water standing in the well) (7.48 gallons/cubic feet) Total water volume (gallons) = well volume + holding tank volume.
2. If a tap is available between the well head and the holding tank, purge three well volumes from the system. If no tap is available, purge the total water volume calculated above from the system, plus two well volumes. If information concerning well depth or holding tank volume is not available, purge the well for 30 minutes.
3. Collect the sample from the tap closest to the well head, before the water is processed through any water-treatment devices. If it is not possible to sample before a treatment device, note this in the sample logbook. Do not take the sample from the garden hose used to route the water away from the house.

Note: Some well owners may be reluctant to allow their water to run for the periods of time involved in purging three well volumes, or even for 30 minutes. Community relations considerations must be weighted against the need to purge the well for lengthy periods, with the sampler having to make a judgement as to what actions should be taken. Fifteen minutes should be considered the minimum amount of purge time permissible, with longer periods desirable.

4. Collect samples in the appropriate containers, secure lids, and attach labels which have been completely filled out. Place samples in a cooler packed with ice for subsequent shipment to the laboratory.
5. Log samples in on a sample log sheet and chain-of-custody form. Note type of plumbing (i.e., copper or lead) and any upstream treatment device.

**EPA REGION II**  
**SCANNING TRACKING SHEET**

DOC ID # 54373

DOC TITLE/SUBJECT:  
**FIGURE 2**  
**SOIL SAMPLE**  
**LOCATION MAP**

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DOC TITLE/SUBJECT:

**FIGURE 6**

**SITE MAP**

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NEW YORK, NY 10007

**EPA REGION II**  
**SCANNING TRACKING SHEET**

DOC ID # 54373

DOC TITLE/SUBJECT:

**FIGURE 5**  
**SOIL SAMPLE**  
**LOCATION MAP**

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**NEW YORK, NY 10007**

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**SCANNING TRACKING SHEET**

DOC ID # 54373

DOC TITLE/SUBJECT:  
**FIGURE 8**

**WELL LOCATION MAP**

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**290 BROADWAY, 18<sup>TH</sup> FLOOR**  
**NEW YORK, NY 10007**

GROUND WATER SAMPLING FIELD LOG

Sample Location \_\_\_\_\_ Well No. \_\_\_\_\_  
Sampled By \_\_\_\_\_ Date \_\_\_\_\_ Time \_\_\_\_\_  
Weather \_\_\_\_\_ Sampled with Bailer \_\_\_\_\_ Pump \_\_\_\_\_

A. WATER TABLE:

Well depth: \_\_\_\_\_ ft.      Well elevation: \_\_\_\_\_ ft.  
(below top of casing)      (top of casing)  
Depth to water table: \_\_\_\_\_ ft.      Water table elevation: \_\_\_\_\_ ft.  
(below top of casing)  
Length of water column (LWC) \_\_\_\_\_ ft.  
Volume of water in well:  
    2" diameter wells =  $0.163 \times (\text{LWC}) =$  \_\_\_\_\_ gallons  
    4" diameter wells =  $0.653 \times (\text{LWC}) =$  \_\_\_\_\_ gallons  
    6" diameter wells =  $1.469 \times (\text{LWC}) =$  \_\_\_\_\_ gallons

B. PHYSICAL APPEARANCE AT START:

Color \_\_\_\_\_ Odor \_\_\_\_\_ Turbidity \_\_\_\_\_  
Was an oil film or layer apparent? \_\_\_\_\_

C. PREPARATION OF WELL FOR SAMPLING:

Amount of water removed before sampling \_\_\_\_\_ gallons.  
Did well go dry? \_\_\_\_\_

D. PHYSICAL APPEARANCE DURING SAMPLING:

Color \_\_\_\_\_ Odor \_\_\_\_\_ Turbidity \_\_\_\_\_  
Was an oil film or layer apparent? \_\_\_\_\_

E. CONDUCTIVITY \_\_\_\_\_

F. pH \_\_\_\_\_

G. TEMPERATURE \_\_\_\_\_

H. WELL SAMPLING NOTES:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

APPENDIX J  
SAMPLE CUSTODY



## SAMPLE CUSTODY

### General

Sample custody procedures for this project will be in strict conformance according to EPA requirements and procedures set forth in NEIL Policies and Procedures (EPA-380/9-78-001-R Revised June 1985).

All samples collected for analysis will be taken by chemists, physical scientists, or other qualified personnel designated by O'Brien & Gere. Blank samples and duplicate samples will be taken at a ratio of 1:10 for each sample location. All samples will be placed in the custody of the sample custodian responsible for sample log-in and tagging. Stored samples (including archive portions) will be catalogued and stored may be audited by the QA Officer.

### Chain of Custody Procedures

The consequences of a controlled hazardous waste site investigation are difficult to predict. There is a possibility that several years after the RI/FS is complete there will be litigation. For that reason, it is imperative that an accurate record be maintained and documented of sample collection, transport, analysis and disposal.

Therefore, chain of custody procedures are instituted and followed throughout the study.

Chain of custody procedures include field custody, laboratory custody, and evidence files. Samples are physical evidence and should be handled according to procedural safeguards. The project coordinator must be prepared to produce documentation that traces the samples from the field to the laboratory and through the analysis. The National Enforcement Investigation Center (NEIC) of the U.S. EPA defines custody of evidence in the following ways:

- In actual physical possession
- In view after being in physical possession
- In a locked repository
- In a secure, restricted area

Chain of custody records begin in the field when sample collection has been completed. See Figure J-1 "Chain of Custody Form" for a typical arrangement of the paper samplers use to complete their field logs. On that form, they note sample location, station number, equipment employed during collection, number of containers for each sample location, physical characteristics of samples, analysis required, date, time of day and any abnormalities during sampling.

The sampler completes the custody form, packages the samples including the custody form, and seals the package with packing tape. Shipment may be made by commercial vendors, and their policy is to document the transfer of the package within their organization. Therefore, when the sample arrives at the laboratory, the sample custodian signs the vendors air bill or bill of lading. The sample custodian's duties and responsibilities upon sample receipt are:

- Document receipt of samples.
- Inspect sample shipping containers for presence or absence of custody seals, locks, evidence tape, container integrity.
- Record condition of shipping and sample containers in logs.
- Sign appropriate forms or documents.
- Verify and record agreement or disagreement of information on sample documents. If there is discrepancy, record the problem and notify the project officer.
- Label sample with laboratory sample number (if not completed in the field).
- Place samples in storage, including secure storage.

The hand-to-hand custody of samples in the laboratory is maintained through preparation and analysis. The analyst is required to log samples into and from secure storage as the analysis proceeds. Samples are returned to secure storage at the close of business. Log sheets incorporate options for multiple entries, because several people handle the samples throughout the analytical scheme.

The laboratory records may also be used as evidence in enforcement proceedings, therefore care must be exercised to properly complete, date and sign items needed to generate data. Copies of the following items are stored:

- Documentation of the preparation and analysis of samples, including copies of the analyst's notebooks.
- Bench sheets, graphs, computer printouts, chromatographic outputs, mass spectral outputs.
- Copies of all QA/QC data.
- Instrument logs showing date, time and analyst.
- Analytical tracking forms which record date, time and analyst for each step of sample preparation and analysis.

Upon completion of analysis, the project coordinator or his assignee should commence assimilating all the field and laboratory notes. It is they who generate the evidence file for the project. The package

is arranged in chronological order for ease of review. When all the information is gathered, the package is inventoried, numbered and stored for future reference.

The sample custodian logs in the samples on a log-in form (Figure J-2) and notes the appropriate information, including sample identification and condition of the samples. Any inconsistencies in paperwork or comments on the condition of the samples are duly noted on the form and filed with the case. The analyst performing the logs out and in the samples from secure storage as the analyses are completed (Figure J-3). To further document the custody of each sample, the analyst will complete Figures J-4, J-5, J-6, J-7 and J-8. Sample Tracking, Sample Preparation and Extraction Log, Surrogate Standard Work Sheet, GC Logbook, and GC/MS Logbook, respectively. In all cases the chemist or technician signs and dates the appropriate forms when handling the samples.

During the analysis, these forms will be maintained in a secure file. Following the completion of a group of samples all appropriate forms and data sheets will be gathered and stored in the files. If necessary, the files will be purged of all the appropriate records and transmitted to the Project Officer.



UA . .

SAMPLE CUSTODIAN SIGNATURE: \_\_\_\_\_

DOCUMENT CONTROL # \_\_\_\_\_

CIRCLE THE APPROPRIATE RESPONSE

- |                                      |                                                         |
|--------------------------------------|---------------------------------------------------------|
| 1. Custody Seal                      | present/absent<br>intact/not intact                     |
| 2. Chain-of-Custody                  | present/absent                                          |
| 3. Sample Tags<br>Sample Tag Numbers | present/absent<br>listed/not listed on chain-of-custody |
| 4. SMO Forms                         | present/absent                                          |

CASE NUMBER \_\_\_\_\_

AIRBILL NUMBER \_\_\_\_\_

[illegible]

**FIGURE J-2**

**NLI 001 0690**

..MPLL JNIR..RECL..

[illegible]

**FIGURE J-3**

NLI 001 0691

## SAMPLE TRACKING FORM

CASE NO. \_\_\_\_\_ PAGE NO. \_\_\_\_\_ OF \_\_\_\_\_

[illegible]

**FIGURE J-4**

NLI 001 0692

**CEC**

LABORATORIES, INC.

**LARSEN STONE, INC.**

ANALYSIS	METHOD	PROJECT #			CLIENT NAME
		Client	Job	Phase	
AE ( )	624 ( )				
BN ( )	625 ( )				
AE/BN ( )	CLP ( )				
VOA ( )	Dioxin 613 ( )				
Pesticide/PCB ( )	Dioxin IFB ( )				
Other	Other				

[illegible]

Notes: FB = Field Blank  
MB = Method Blank  
MS = Matrix Spike of Sample #  
MSD = Matrix Spike Duplicate of Sample #  
D = Duplicate of Sample #

**Extracted By**

Received For Analysis By

**Comments:**



SURROGATES STANDARDS1. BNAs CLP

Surrogates Stock Solution # \_\_\_\_\_ AE SS Conc. \_\_\_\_\_ BN SS Conc. \_\_\_\_\_

Surrogate	Volume SS Stock Used	Conc. ug/ml	Monogram Spk Added
Phenol d-5			
2-Fluorophenol			
2,4,6-Tribromophenol			
Nitrobenzene d-5			
2-Fluorobiphenyl			
Terphenyl d-14			
Other(s):			

2. VOAs CLP

Surrogates Stock Solution # \_\_\_\_\_ Conc. \_\_\_\_\_

Surrogate Standards	Volume SS Stock Used	Conc. ug/ml	Nanogram Spk Added
4-Bromofluorobenzene			
1,2-Dichloroethane d-4			
Toluene d-8			
Other(s)			

3. Other CLPs


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**FIGURE J-**

DATE \_\_\_\_\_ INSTRUMENT \_\_\_\_\_

DETECTOR/MODE \_\_\_\_\_

**COLUMN** \_\_\_\_\_

DETECTOR TEMP \_\_\_\_\_ °C

IP TEMP \_\_\_\_\_ °C      TRANSFER LINE \_\_\_\_\_ °C

FURNACE TEMP \_\_\_\_\_ °C

TEMP PROGRAM: Oven \_\_\_\_\_ °C TO \_\_\_\_\_ °C At \_\_\_\_\_ °C/min

SOLVENT/FLOW \_\_\_\_\_ ml/min

INITIAL HOLD \_\_\_\_\_ min FINAL HOLD \_\_\_\_\_ min

CARRIER FLOW \_\_\_\_\_ ml/min

GAS 1/FLOW \_\_\_\_\_ ml/min

GAS 2/FLOW \_\_\_\_\_ ml/min

COMMENTS: \_\_\_\_\_

[illegible]

CAGAS NO. \_\_\_\_\_

SIGNATURE(S) \_\_\_\_\_

Date _____ Instrument _____	Project #			Client Name
Column _____	Client	Job	Phase	
_____				
_____				
_____				
_____				
_____				

[illegible]

Notes: FB = Field Blank  
MB = Method Blank  
MS = Matrix Spike of Sample # \_\_\_\_\_  
MSD = Matrix Spike Duplicate of Sample # \_\_\_\_\_  
D = Duplicate of Sample # \_\_\_\_\_  
IS = Internal Standard(s)  
DF = Dilution Factor

Analyzed by \_\_\_\_\_

Signatures(s)\_\_\_\_\_

Comments \_\_\_\_\_

APPENDIX K  
CURRICULUM VITAE

## CURRICULUM VITAE

This appendix presents the curriculum vitae of all professionals expected to participate significantly in the implementation of the NSNJ Site RI, with the exception of regulatory agency personnel. A description of the project responsibilities of each professional is presented below:

### Stephen W. Holt, P.E., C.S.P. - NL Industries, Inc. - Project Manager

As Project Manager for NL, Mr. Holt will be responsible for the overall coordination of the project in NL's behalf. Mr. Holt will be responsible for overseeing all facets of the project on a day-to-day basis, including the following:

- Project scheduling
- Project coordination and communication
- Budget control
- Contractor and subcontractor performances review
- Review and submission of reports
- Project close-out

### Steven R. Garver, P.E. - O'Brien & Gere Engineers, Inc. - Project Director

Mr. Garver will be responsible for the overall management of OBG's activities throughout the duration of the RI/FS. Specific management responsibilities of the OBG Project Director include:

- Project performances evaluation
- Project quality
- Project schedule
- Project cost
- Personnel allocations
- Continuous monitoring and control of program tasks

### Frank D. Hale - O'Brien & Gere Engineers, Inc. - Project Manager

Mr. Hale will be responsible for overseeing all facets of OBG's project activities on a day-to-day basis. Specifically, his responsibilities as OBG Project Manager will include:

- Project scheduling
- Budget control
- Review and submission of reports
- Project coordination and communication between OBG and NL
- Task and project quality

Swiatoslav Kaczmar, Ph.D., C.I.H. - O'Brien & Gere Engineers, Inc. - Safety Officer

Dr. Kaczmar will be responsible for all OBG safety issues during implementation of the RI. He will ensure that all OBG personnel involved in on-site activities have completed all OSHA Safety Training requirements and that they are familiar with site health and safety procedures as specified in the Health and Safety Plan and Contingency Plan.

Douglas M. Crawford - O'Brien & Gere Engineers, Inc. - Assistant Project Manager - Engineering

Mr. Crawford will be responsible for overseeing OBG's engineering aspects of the project on a day-to-day basis.

Guy A. Swenson - O'Brien & Gere Engineers, Inc. - Assistant Project Manager - Hydrogeology

Mr. Swenson will be responsible for overseeing OBG's day-to-day hydrogeological activities relative to the project.

Steven J. Roland, P.E. - O'Brien & Gere Engineers, Inc. - Field Investigation

Mr. Roland will be responsible for supervising all phases of the on-site field investigation team.

David R. Hill - OBG Laboratories, Inc. - Laboratory manager, QA/QC Officer

Mr. Hill will serve as the Laboratory manager and QA/QC Officer for the project. As Laboratory Manager, he will be responsible for the overall administration of the analytical operations of OBG Labs. As QA/QC Officer for OBG Labs, Mr. Hill will be responsible for the implementation, monitoring, and supervision of the QA/QC program. He will assure that the program is conducted in strict adherence to the procedures and requirements outlined for this program. Specifically, his duties will include:

- Insuring laboratory custody procedures are followed
- Monitoring daily precision and accuracy records
- Maintaining copies of all procedures routinely used
- Implementing corrective measures if result are "out of control"
- Rescheduling analyses based upon unacceptable accuracy or precision data
- Validate all data
- Submit all data to OBG

Donald R. Brondou - OBG Laboratories, Inc. - Inorganics Group Leader

Mr. Brondou will be responsible for the day-to-day operation of the Inorganic Chemistry Group at OBG Labs. Included in his duties relative to this project are the following:

- Manage laboratory technical personnel
- Approve analytical methods, sampling procedures, special QA/QC procedures, and any subsequent revisions in analytical procedures
- Approve completed work

A. Robert Martin - OBG Laboratories, Inc. - Organics Group Leader

Mr. Martin will be responsible for the day-to-day operation of the Organic Chemistry Group at OBG Labs. His duties include the following:

- Manage laboratory technical personnel
- Approve analytical methods, sampling procedures, special QA/QC procedures, and any subsequent revisions in analytical procedures
- Approve completed work

Donald F. Shutz, Ph.D. - Teledyne Isotopes - Laboratory Manager

Dr. Shutz will serve as the Teledyne Isotopes Laboratory Manager for the project. As Laboratory Manager, he will be responsible for the overall administration of the analytical operations of Teledyne Isotopes. Specifically, his duties will include:

- Project coordination between Teledyne and OBG.
- Project quality
- Review of project communication
- Budget control

J. David Martin, Ph.D. - Teledyne Isotopes - Radionuclide Group Leader

Dr. Martin will be responsible for the day-to-day operation of the Radionuclide Analysis Group at Teledyne. Included in his duties relative to this project are the following:

- Manage laboratory technical personnel
- Approve analytical methods, sampling procedures, special QA/QC procedures, and any subsequent revisions in analytical procedures
- Approve completed work

Helen G. King - Teledyne Isotopes - QA/QC Offices

Ms. King will serve as the QA/QC officer for Teledyne Isotopes. As QA/QC officer, she will be responsible for the implementation, monitoring, and supervision of the QA/QC program. She will assure that the program is conducted in strict adherence to the procedures and requirements outlined for this program. Specifically, her duties will include:

- Insuring laboratory custody procedures are followed
- Monitoring daily precision and accuracy records
- Maintaining copies of all procedures routinely used
- Implementing corrective measures if result are "out of control"
- Rescheduling analyses based upon unacceptable accuracy or precision data
- Validate all data
- Submit all data to OBC



**STEVEN R. GARVER, P.E.  
VICE PRESIDENT**

**BACKGROUND**

Mr. Garver joined O'Brien & Gere in 1973, became a Managing Engineer in 1978, and was promoted to Vice President of the Applied Technology Division in 1985.

Fields of special competence include industrial water and waste management; process development and treatability research; hazardous wastes; biological treatment; water and waste chemistry; environmental regulations.

**EDUCATION**

Pennsylvania State University, 1967, BS/Sanitary Engineering  
Pennsylvania State University, 1968, MS/Sanitary Engineering

**PROFESSIONAL ENGINEERING LICENSES**

New York

**PROFESSIONAL AFFILIATIONS**

American Society of Civil Engineers  
American Water Works Association, Polyelectrolytes Standards Committee  
Water Pollution Control Federation, Program Committee  
Chi Epsilon

**EXPERIENCE**

Supervised the review and evaluation of RCRA Part B permitting materials. Activities have included the development of site specific plans and specifications for waste storage and treatment facilities.

Provided industrial surveys, process development, facility designs and environmental programs, Operation and Maintenance Manuals and operating assistance for industries which produce organic and inorganic chemicals, pharmaceuticals, fertilizers, explosives, oil refining, paper products, photo processing, food goods, fermentation products, electrical and electronic equipment, metal finishing, steel and speciality metals, automotive and aircraft parts.

Developed hazardous waste management and chemical substance spill control programs for a number of clients. These have accomplished more efficient and economical methods for waste recovery or disposal; management of inventories; safety, emergency and training programs; and compliance with state and federal regulations.

Responded to incidents of surficial or subsurface contamination due to disposal or spills of chemical substances with site investigation and remediation programs. Activities have included development of groundwater monitoring programs, treatment of soils and waters, air monitoring, safety

protocols, and site closure and post-closure development. Sites have included those impacted by sanitary refuse, munitions disposal, petroleum spillage, quarry and coal storage operations, surface impoundments containing organic and inorganic waste products, and leakages from underground chemical storage tanks.

Designed and executed bench and pilot scale treatability studies for a variety of purposes including investigation of inhibitory impacts, evaluation of alternatives, design development, and new process research.

Applied and investigated the following technologies: aerobic and anoxic biological treatment, activated carbon absorption, precipitation, coagulation/flocculation, gravity sedimentation and thickening, air flotation, multimedia filtration, membrane systems, ion exchange, distillation/evaporation, centrifugation, vacuum and pressure filtration, disinfection, nitrification/denitrification, air stripping, countercurrent and stagnant rinse operations, water conservation through conductivity monitoring and improved housekeeping, source segregation of concentrated waste streams, and materials reuse and recovery.

Developed, calibrated and applied mathematical models for gravity separation systems, high-rate disinfection, heat loss from biological systems, hydrologic transport and assessment of wet-weather impulse loadings to municipal treatment systems.

Supervised and assisted in the development of industrial pretreatment programs for nine municipalities. These projects included development of industrial inventories, evaluations of ordinances, determination of impacts of industrial discharges, development of enforcement programs and public participation.

**Governmental clients:**

U.S. Army Corps of Engineers  
U.S. Environmental Protection Agency  
District of Columbia  
Monroe County, NY  
Herkimer County, NY  
Kent County, DE  
City of Poughkeepsie, NY  
City of Jamestown, NY  
City of Auburn, NY

Naval Air Propulsion Center  
Naval Surface Weapons Center  
NYS Department of Environmental Conservation  
Onondaga County, NY  
Westchester County, NY  
Howard County, MD  
City of Dunkirk, NY

**Industrial clients:**

IBM Corporation  
General Electric Company  
Cyanamid Canada  
Norwich-Eaton Pharmaceuticals  
Bristol Laboratories  
Eastman Kodak Company  
Special Metals Corporation  
W.R. Grace  
Nestle

Xerox  
PCA International  
Canandaigua Wine Company  
Pillsbury  
Goulds Pumps  
Simmonds Precision  
Will & Baumer  
American Cyanamid Company  
Sterling Drug, Inc.

Knowlton Brothers  
Moog Automotive  
Johnson & Johnson  
New York Air Brake Company  
Syracuse China  
Blackstone Corporation  
Solvents and Petroleum Services, Inc.  
Carrier Corporation  
Environmental Oil Corporation  
Cornell Dubilier, Inc.  
SCM Corporation  
Borg-Warner Chemicals, Inc.

Richardson Corp.  
Black Clawson Company  
Lyndonville Canning Company  
Warner-Lambert  
Newton Falls Paper Company  
Chemical Process & Supply Co.  
FMC Corporation  
E.J. DuPont  
McKesson Envirosystems  
Pico Products, Inc.  
Westinghouse Corporation

#### PUBLICATIONS

Photometric Determination of Trace Cationic Polyelectrolytes in Water, presented at the Fourteenth Annual Eastern Analytical Symposium, Atlantic City, NJ, November 1972.

Multiple Reuse of Photo Processing Wastewaters using Reverse Osmosis, Brine Reclamation and Cooling Tower Application, presented at the Seventh Mid-Atlantic Industrial Waste Conference, November 1974.

Industrial Wastes: Segregation versus End-of-pipe Treatment, presented at the New York Water Pollution Control Association Annual Meeting, January 1977.

High-Rate Disinfection: Chlorine versus Chlorine Dioxide, ASCE Journal EED, 103, EE6, December 1977.

Cost-Performance Comparisons of Swirl Separators and High-Rate Sedimentation, presented at the Water Pollution Control Federation Annual Conference, October 1977.

Design Optimization of High-Rate Disinfection using Chlorine and Chlorine Dioxide, Journal Water Pollution Control Federation, 51,351, February, 1979.

Combined Sewer Overflow Abatement Program, Rochester, NY, Volume II, Pilot Plant Evaluations, EPA-600/2-79-031b, July 1979.

Management of Hazardous Wastes: The Methodology and Utility of Conducting a First Phase Hazardous Waste Survey, presented at the Twelfth Mid-Atlantic Industrial Waste Conference, July 1980.

Resource Conservation and Recovery Act: Problems of Compliance, presented at the Spring Meeting 1981, New York Water Pollution Control Association, June 1981.

Chemical Substance Regulations and the Plant Operator, presented at the Fall meeting 1981, Central Chapter New York Water Pollution Control Association, October 1981.

Design Selection for Storage of Toxic or Hazardous Substances, presented at the Fourteenth Mid-Atlantic Industrial Waste Conference, June 1982.

Selecting Systems and Equipment for Industrial Wastewater Management, Specifying Engineer, 48,3, September 1982.

Review of New York's Bulk Storage of Hazardous Liquids Study Program, presented at the Underground Leaks Workshop, University of Maryland Fire & Rescue Institute, October 1982.

Siting Manual for Storing Hazardous Substances, developed for New York State Department of Environmental Conservation, October 1982.

The Hazardous Waste Regulation Maze, Pollution Engineering, 14,11, November 1982.

Viscous Bulking of Activated Sludge, presented at the Water Pollution Control Federation Annual Conference, October 1983.

Chemical Equilibrium Model used for Hazardous Waste Impoundment Closure, AIChE Diamond Jubilee/Annual Meeting, Washington, D.C., October 30 - November 4, 1983.

Safe Storage for Hazardous Materials, Hazardous Materials and Waste Management, 1,6, November/December 1983.

Administrative and Legal Options for Storing Hazardous Substances, developed for New York State Department of Environmental Conservation, February 1984.

Evaluating Sites for Storing Hazardous Substances, Association of Towns of the State of New York, Annual Meeting, February 22, 1984.

Treatment of High Strength Industrial Waste by Extended Aeration, Joint New England - New York Water Pollution Control Associations Spring Meeting, June 4, 1984.

A Rational Procedure for Establishing Discharge Concentration Limits in Municipal Sewer Use Ordinances, Sixteenth Mid-Atlantic Industrial Waste Conference, Pennsylvania State University, June 25, 1984.

**FRANK D. HALE  
RESEARCH MANAGER**

**BACKGROUND**

Mr. Hale joined O'Brien & Gere in 1978, was promoted to Project Manager in 1981 and Research Manager in 1985.

During his period with O'Brien & Gere he has worked primarily on projects for industrial clients in the areas of wastewater treatability and remedial investigations. Specialized training in Hazardous Incident Response (EPA 165.5) has been used during development of safety plans and sampling protocols.

**EDUCATION**

University of Rochester, 1969, BA/Psychology  
Syracuse University, 1979, MS/Sanitary Science

**PROFESSIONAL AFFILIATIONS**

Water Pollution Control Federation  
ASTM-Committee on Hazardous Substance and Oil Spill Response

**EXPERIENCE**

**EXPERT WITNESS AND LITIGATIVE SUPPORT**

The following activities represent projects which involved working directly for counsel in defense against criminal charges or during negotiations with agencies. Law firms for which activities were conducted included:

Beveridge and Diamond  
Bond, Schoeneck, and King  
Mac Kenzie, Smith, Lewis, Mitchell & Hughes  
Harter, Secrest & Emery  
Nixon, Hargrave, Deans, and Doyle  
Davis, Malm & D'Agostine

Confidential, New York State - Provided litigative support for defense against state civil and criminal charges associated with RCRA and discharge permit violations.

Confidential, New York State - provided expert testimony and litigative support for defense against Federal civil and criminal charges associated with RCRA violations.

Confidential, New York State - provided litigative support for defense against state civil charges associated with discharge permit excursions.

Confidential, New York State - Provided litigative support for defense against state civil and criminal charges associated with a PCB spill.

Confidential, New York State - Provided litigative support for defense against state civil charges associated with PCB releases.

Confidential, New York State - Provided litigative support during the negotiation of Consent Orders with state and federal agencies on nine sites.

Confidential, Pennsylvania - Provided litigative support during audit of heavy metal contaminated site.

#### CERCLA ACTIVITIES

FMC Corporation - Project Manager for RI/FS at a major pesticide manufacturing facility.

NL Industries, Illinois Superfund Site, Project Manager for RI/FS at Granite City, Illinois - secondary lead smelter.

NL Industries, Minnesota Superfund Site, Project Manager for RI at St. Louis, Park, Minnesota - secondary lead smelter.

NL Industries, USEPA Superfund Site, Project Manager for RI/FS at Pedricktown, New Jersey - secondary lead smelter.

American Cyanamid, USEPA Superfund Site - Manager responsible for sampling, analysis, and presentation of data on several lagoons located at Bound Brook Facility.

Ludlow Sanitary Landfill, USEPA Superfund Site, New York - Project Manager for RI/FS on behalf of PRP group.

Town of Conklin, USEPA Superfund Site, New York - Project Manager for RI/FS at two landfills.

Endicott Johnson, New York State Superfund Site - Project Manager for RI/FS at former manufacturing site for adhesive formulation.

Roberts & Carlson, New York State Superfund Site - Project Manager for RI/FS of site with heavy metal contamination.

Harden Furniture Company, New York State Superfund Site - Project Manager for RI/FS of site.

Peter Cooper Corporations, New York State Superfund Sites - Project Manager for RI/FS at two separate sites in western New York.

Moog Automotive, Maryville Missouri - Project Manager for development of RCRA closure plan which included treatment and disposal of 33 million gallons of spent pickle liquor. Also provided on-site start-up and operational supervision.

## PCB ACTIVITIES

Massachusetts - Conducted bench scale and pilot treatability tests for PCB removal from combined sewer at a manufacturing facility.

Massachusetts - Conducted treatability tests and supervised construction and startup of a temporary treatment system to remove PCBs from lagoon waters prior to closure of lagoon.

New York - Conducted industrial site survey to determine sources of PCB-contaminated oil at a major manufacturing facility. Supervised clean-up and supplemental testing.

Illinois - Conducted solidification fixation test for PCB-contaminated sediments. The results were used to select a technology for solidification of PCB wastes and encapsulation in an on-site landfill.

New York - Developed closure approach for PCB-contaminated wetland. Program involved sampling, analysis, and development of cost estimate for several options.

New York - Developed ground water treatment approach for PCB removal at a landfill.

## WASTEWATER, INDUSTRIAL

Confidentiality agreements preclude specific client identification.

Conducted or directed projects including comprehensive plant inventories and preparation of mass balances, preparation of RCRA permit applications and compliance reports (contingency plans, waste sampling and analysis plans, ground water monitoring plans, closure and post-closure plans, etc.) and development of site remediation programs.

Conducted or directed numerous biological bench and pilot scale treatability studies for industrial clients. Study objectives have included combined municipal/industrial treatment, aerobic facility expansion, identification of inhibitory/toxic process streams and low temperature operation. Principal clients manufacture wines, food products, pharmaceuticals, plastics, fertilizers, organic chemicals, and pesticides.

Conducted or directed numerous bench scale studies evaluating such physical/chemical processes as: break point chlorination of high strength industrial wastes; activated carbon adsorption of ground water and process wastes; and neutralization, coagulation, flocculation and sedimentation of inorganic process waste streams. Industries served include: metal finishing, transformer manufacturing, pharmaceuticals, and electronic components manufacturing.

Conducted bench scale tests evaluating methods of dewatering process wastes and lagoon sediments. Results of bench scale tests were used to design pilot scale tests on solids dewatering using recessed plate pressure filters and rotary vacuum filters. Clients included manufacturers of food products, pharmaceuticals, transformers, and steel products.

Prepared computer models to determine heat loss from aerobic lagoons. Also developed a model of process design parameters for air stripping chlorinated solvents from process wastewater and ground water. Model results identified methods for optimizing performance and/or design for the industrial clients.

Clients have included:

Warner Lambert Company	USV Laboratories
American Cyanamid	Pillsbury Company
Canandaigua Wine Company	Special Metals Corporation
General Electric Company	Moog Automotive, Inc.
International Business Machines	Hamilton Digital Controls
Norwich Eaton Pharmaceuticals	Eaton Laboratories
FMC Corporation NL Industries	Corning Glass Works
Endicott Johnson Companies	Armstrong World Industries
Harden Furniture Company	US Army Corps of Engineers
Syracuse China Company	Cyanamid Canada
Chicago Pneumatic Tool Company	J.T. Baker

PUBLICATIONS

Management of Hazardous Wastes: The Methodology and Utility of Conducting a First Phase Hazardous Waste Survey, presented at the Twelfth Mid-Atlantic Industrial Waste Conference, July 1980.

Whole Lake Responses to Low Level Copper Sulfate Treatment, Water Research, 14: 1489, 1980.

Phosphorous Compartmentalization and Its Response to Copper Sulfate Application, presented at the 41st Annual Meeting, American Limnology and Oceanography, 1978.

Aquatic Macrophyte Control in Cazenovia Lake, 1977, in The Cazenovia Lake Project I, Syracuse University Department of Civil Engineering, 1977.

Resource Conservation and Recovery Act: Problems of Compliance, presented at the Spring Meeting 1981, New York Water Pollution Control Association, June 1981.

Biological Treatability of Toxic and Hazardous Materials, presented at First International Symposium on Toxicity Testing Using Bacteria, May, 1983.

Viscous Bulking of Activated Sludge, presented at the WPCF Industrial Waste Symposia in Atlanta during October 1983.

Spent Acid and Plating Waste Surface Impoundment Closure presented at HMCRI Conference October 1983.

Treatment of High Strength Industrial Waste by Extended Aeration presented at NEWPCA/NYPCA Conference June 1984.

Hazardous Liquid Spill Recovery and Treatment, presented at the International Conference of AWWA and WPCF in Melbourne, Australia, 1985.



**DOUGLAS M. CRAWFORD  
PROJECT ENGINEER**

**BACKGROUND**

Mr. Crawford joined O'Brien & Gere as a Research Engineer in 1983. He was promoted to Project Engineer in 1985. Prior to joining the Firm, he was with another consulting firm and previously, a research assistant with the University of Cincinnati and U.S. Environmental Protection Agency.

Fields of special competence include hazardous waste site investigations and remedial designs/implementation; hydrology and hydraulics; combined sewer overflow investigations; wastewater collection and conveyance systems; and industrial wastewater.

**EDUCATION**

Union College, 1980, BS/Environmental Studies - Civil Engineering  
University of Cincinnati, 1983, MS/Civil Engineering

**PROFESSIONAL AFFILIATIONS**

American Society of Civil Engineers

**SPECIAL QUALIFICATIONS**

University of Wisconsin Course: "Ground Water Modeling"

University of Cincinnati/USEPA: Instructor for workshop - "Hydrologic Flow and Contaminant Transport Modeling."

**EXPERIENCE**

**HAZARDOUS WASTE MANAGEMENT:**

Experience includes hazardous waste site assessments, remedial investigations, feasibility studies; design of waste management facilities; and ground water flow and contaminant transport modeling.

Confidentiality agreements preclude specific client identification in some instances.

Representative projects include:

Roberts and Carlson, Inc. - Site assessment and feasibility study at New York. Superfund site to evaluate the extent of environmental contamination from waste disposal practices and to identify and design the most appropriate remedial response. The environmental contamination included heavy metals in soil, ground water, and surface water.

NL Industries, Inc. - Remedial Investigation/Feasibility Studies at three USEPA Superfund Sites to evaluate the extent of environmental contamination resulting from lead smelting operations and to identify and design the most appropriate remedial responses. The investigations were largely concerned with heavy metals in soil, ground water, and surface water.

Ludlow Sanitary Landfill, NY - Remedial Investigation/Feasibility Study at USEPA Superfund Site to evaluate the extent of environmental contamination resulting from waste disposal practices and to identify and design the most appropriate remedial response. The investigation was primarily concerned with PCBs in soil, ground water, and surface water.

Endicott Johnson - Remedial Investigation/Feasibility Study at New York State Superfund Site to evaluate the extent of environmental contamination resulting from manufacturing operations and to identify and design the most appropriate remedial response. The investigation centered around organic solvents in soil, ground water, and air.

Brookhurst Subdivision, WY - Remedial Investigation/Feasibility Study at USEPA Superfund Site to evaluate the extent of environmental contamination resulting from waste disposal practices and to identify and design the most appropriate remedial response. The investigation was primarily concerned with organic solvents in soil and ground water.

Major Electronics Manufacturer - Site assessment of manufacturing facilities to evaluate the extent of environmental contamination resulting from manufacturing and waste disposal operations. The assessment was largely concerned with organic solvents in process sewers, soil, and ground water.

Major Electric Motor Manufacturer - Design and implementation of study to evaluate alternative decontamination technologies for a manufacturing facility contaminated with PCBs.

Major Aircraft Components Manufacturer - Evaluation of innovative hazardous waste landfill design with respect to hydrologic issues including cap and liner system effectiveness, and leachate generation. Application of USEPA Hydrologic Evaluation of Landfill Performance (HELP) Model.

Major Pesticide Manufacturer - Development and application of ground water model; evaluation of off-site migration potential of contaminated ground water.

U.S. Environmental Protection Agency - Computer modeling and analytical evaluation of ground water flow and contaminant transport scenarios with respect to the RCRA regulations.

U.S. Environmental Protection Agency - Development and enhancement of Solid and Hazardous Waste Research Division's ground water modeling capabilities, with specific reference to ground water flow, contaminant transport, and the evaluation of remedial response technologies as applied to hazardous waste sites.

Monroe County, NY - Development and implementation of closure plan for retention ponds and surrounding soils contaminated with coal tar compounds.

#### **WASTEWATER, MUNICIPAL:**

Experience includes instrumentation and control studies; infiltration/inflow and sewer system evaluation studies; combined sewer overflow investigations; and wastewater treatment.

Representative projects include:

Monroe County, NY - Development of control logic for computer-based operation of

municipal wastewater collection, conveyance, and treatment systems and associated facilities.

Westchester County, NY - Hydraulic computer modeling and evaluation of sewer system and associated infiltration/inflow remediation alternatives.

Metropolitan Washington Council of Governments - Application of USEPA Simplified Stormwater Management Model; evaluation of combined sewer overflows and system-wide operational strategies.

U.S. Environmental Protection Agency - Evaluation of the effects of sanitary landfill leachate on a conventional activated sludge process.

#### **WASTEWATER, INDUSTRIAL:**

Experience includes industrial discharge monitoring and evaluation; and design of industrial wastewater treatment facilities.

Confidentiality agreements preclude specific client identification.

Representative projects include:

Major Chemical Manufacturer - Development and implementation of field test to evaluate flow monitoring systems in response to regulatory discharge requirements.

Major Chemical Manufacturer - Evaluation of design requirements for GAC-based industrial wastewater treatment system.

Major Pharmaceutical Manufacturer - Development of closure plan for industrial wastewater flow equalization basin.

#### **WATER QUALITY STUDIES:**

Experience includes limnological evaluations of freshwater lakes.

Representative projects include:

U.S. Environmental Protection Agency - Evaluation of hydraulic dredging of lake sediments on eutrophication processes.

The Gahada and Tawiskarou Association, Jenny Lake, Saratoga County, NY - Evaluation of limnological condition of Jenny Lake.

#### **PUBLICATIONS**

**Purpose and Execution of Field Investigations**, Crawford, Douglas M. and Hale, Frank D. in Hazardous Waste Site Remediation: The Engineer's Perspective, Van Nostrand Reinhold Company (in press).

**Developing the Feasibility Study**, Crawford, Douglas M., Garver, Steven R., and Jenczewski, Theodore J. in Hazardous Waste Site Remediation: The Engineer's Perspective, Van Nostrand Reinhold Company (in press).

**GUY A. SWENSON, III**  
**SENIOR PROJECT HYDROGEOLOGIST**

**BACKGROUND**

Mr. Swenson joined O'Brien & Gere in 1982. Prior to joining the Firm, he was a consultant for ground water and engineering firms in the Northeast and California, and was employed as a soils engineer in Alaska.

Fields of special competence include ground water resource evaluation for municipal or agricultural water supplies; ground water evaluations at hazardous waste sites; geophysical survey techniques including seismic refraction, electrical resistivity and electromagnetics; geologic mapping; and computer modeling of ground water flow and contaminant transport.

**EDUCATION**

Occidental College, 1974, BA/Geology

San Diego State University, 1981, MS/Geology

WSV/NWWA Summer Field Practice Program: Exploration Geophysics for Engineering and Hydrogeologic Applications I; August 1982

Butler University - Holcomb Research Institute; Basics of Modeling Ground Water Flow and Pollution; March 1983

**PROFESSIONAL AFFILIATIONS**

National Water Well Association

Geological Society of America

**EXPERIENCE**

**WATER RESOURCES:**

Experience includes the evaluation of ground water resources and the design and implementation of ground water supply wells.

Kent County, DE; Onondaga, Cortland and Broome Counties, NY; and Jefferson County, PA - Evaluated ground water resources in unconsolidated deposits and bedrock for municipal water supplies and irrigation systems. Activities included review of aerial photographs, geophysical surveys, exploratory drilling, aquifer performance testing, computer modeling and the design of final production wells.

San Diego County, California and Baja, Mexico - Conducted an extensive study of a rural valley to provide a qualitative description of the ground water hydrology and geology. This study included the use of electrical resistivity surveys, aquifer performance tests, well logging, water chemistry, meteorological data, geologic mapping, literature research and remote sensed data.

New London County, CT - Conducted a seismic refraction survey to delineate bedrock topography for a proposed dam overflow channel.

Onondaga County, NY - Provided technical consulting for the installation of two 1,300 ft. salt brine wells for a local industry.

#### **SOLID WASTE:**

Experience includes hydrogeologic evaluations of proposed landfill sites.

Seneca and Orleans Counties, NY - Performed hydrogeologic evaluation of sites for proposed landfill expansions. Activities included test pits, test borings and the installation of ground water observation wells.

#### **CONSTRUCTION INSPECTION:**

Experience includes activities involved with the installation of the Trans Alaskan Oil Pipeline.

Trans Alaskan Oil Pipeline, Alaska - Soils engineer with the responsibility of inspecting the installation of vertical supports and authorizing field re-designs.

#### **HAZARDOUS WASTE MANAGEMENT:**

Experience includes site investigations and assessment, remedial design and risk assessment for industrial waste facilities, containment bases and petroleum hydrocarbon bases.

Seneca, Washington, Niagara Counties, New York, Union County, New Jersey, King George, Virginia and Monroe Counties, IN - Responsible for supervising and performing site investigations and hydrogeologic assessments of both active and closed municipal and industrial landfills. Activities included: the review of hydrogeologic literature and historic aerial photographs; geologic mapping; geophysical surveys; the installation of test borings and monitor wells; soil and ground water sampling; geologic evaluation of the sites; evaluations of the direction and rate of ground water flow; computer modeling of ground water flow and contaminant transport; and negotiations with regulatory agencies.

Somerset County, NJ and Monroe County, NY - Responsible for supervising and performing site investigations and hydrogeologic assessments of active and closed waste lagoons at industrial facilities. Activities included: the review of hydrogeologic literature and historic aerial photographs; geologic mapping; geophysical surveys; the installation of test borings and monitor wells; soil and ground water sampling; geologic evaluations of the sites; and evaluations of the direction and rate of ground water flows.

Somerset, Burlington, Essex and Middlesex Counties, NJ; Fredrick, Howard and Carrol County, MD; King George County, VA; Cortland, Broome, Oneida and Monroe and Indiana Counties, New York; Cumberland County, IL; Ponce Area, Puerto Rico; Gujarat State, India; Hamden and Norfolk Counties, MA and Monroe County, PA - Responsible for

supervising and performing site investigations and hydrogeologic assessments of sites of organic and inorganic contaminant bases and disposal at both industrial and non-industrial facilities. Hydrogeologic environments have included unconsolidated glacial, fluvial and marine deposits and fractured bedrock and karst terrain. Activities included: the review of hydrogeologic literature and historic aerial photographs; geologic mapping; geophysical surveys; the installation of test borings and monitor wells; soil and ground water sampling; geologic evaluations of the site; evaluations of the direction and rate of ground water flow, ground water elevation monitoring, aquifer performance tests, computer modeling of ground water flow and contaminant transport; and negotiations with regulatory agencies.

Washington, Saratoga and Indiana Counties, NY and Somerset and Union Counties, NJ - Responsible for supervising and performing hydrogeologic evaluations and design of proposed passive in-place containment structures for municipal and industrial landfills. Activities included: the evaluation of the site hydrogeology for the suitability and effectiveness of passive in-place containment structures; ground water flow modeling of containment structures and negotiations with regulatory agencies.

Cortland, Broome, Monroe and Oneida Counties, NY, Burlington County, NJ, and Norfolk County, MA - Responsible for supervising and performing hydrogeologic evaluations and design of proposed and existing ground water control/recovery systems. Activities included: the evaluation of the site hydrogeology for the implementation of ground water control/recovery systems; the hydrogeologic design of the control/recovery systems; ground water flow and contaminant transport modeling of proposed and existing systems; and negotiations with regulatory agencies.

Monroe County, NY and Monroe County, PA - Conducted hydrogeologic evaluations and predictions for environmental risk assessments at industrial waste facilities. Activities included: evaluations and predictions of the direction and rate of ground water flow and contaminant transport; ground water flow and contaminant transport modeling; and negotiations with regulatory agencies.

#### SPILL PREVENTION CONTROL AND COUNTERMEASURES:

Alameda County, CA; Onondaga County, NY and Essex County, MA - Responsible for supervising and performing site investigations, hydrogeologic assessments and remedial design and implementation for petroleum hydrocarbon losses. Activities included: the review of hydrogeologic literature; geologic mapping; geophysical surveys; the installation of test pits, test borings and monitor wells; soil and ground water sampling; geologic evaluations of the sites; evaluations of the direction and rate of ground water and immiscible product flow; hydrogeologic design and implementation of product recovery systems; and negotiations with regulatory agencies.

#### ENVIRONMENTAL ASSESSMENT:

Experience includes performing hydrogeologic assessments under the NJ ECRA laws and hydrogeologic assessments of pesticide application.

Middlesex and Union Counties, NJ - Responsible for supervising and performing hydrogeologic environmental assessments (NJ ECRA) of industrial facilities. Activities included: the review of hydrogeologic literature; the installation of test borings and monitor wells; soil and ground water sampling; hydrogeologic evaluations of the sites; and negotiations with regulatory agencies.

Caroline and Dorchester Counties, MD - Responsible for supervising and performing an environmental assessment of pesticide applications. Activities included: the review of hydrogeologic and soils literature; the installation of test borings and monitor wells; soil and ground water sampling; and hydrogeologic evaluations of the test sites.

#### PUBLICATIONS

Design and Evaluation of In-Place Containment Structures Utilizing Ground Water Cutoff Walls; Lynch, Edward R., Anagnost, Stephen W., Swenson, Guy A., and Lee, George W; Proceedings of the Fourth National Symposium and Exposition on Aquifer Restoration and Groundwater Monitoring; May 1984.

Post Construction Ground Water Hydraulics at Loeffel Site at Southern Rensselaer County, NY; Lee, George W., Bhatia, S.K., Swenson, Guy A., III, Clemence, S.P.; International Symposium on Case Histories in Geotechnical Engineering, April 1984.

Evaluations of Ground Water Hydraulics with Respect to Remedial Design Blasland, Warren V., Jr., Lee, George W., Jr., Swenson, Guy A., III 4th National Conference on Management of Uncontrolled Hazardous Waste Sites, October 1983.

Upper Cretaceous Deep-Sea Fan Deposits, San Diego co-author; in Geological Excursions in The Southern California Area, Geological Society of America, 1979.

**STEVEN J. ROLAND, P.E.  
MANAGING ENGINEER**

**BACKGROUND**

Mr. Roland joined O'Brien & Gere in 1978 as a Design Engineer and was promoted to Senior Project Engineer in 1984 and Managing Engineer in 1986. He provides technical expertise in the areas of solid/hazardous waste site investigations and remediation design, New Jersey Environmental Cleanup Responsibility Act (ECRA) assessments and cleanup plans, hazardous waste management and industrial wastewater design.

**EDUCATION**

Union College, 1978, BS/Civil and Environmental Engineering

**PROFESSIONAL ENGINEERING LICENSES**

New York  
New Jersey (pending)

**PROFESSIONAL AFFILIATIONS**

American Society of Civil Engineers  
American Water Works Association  
Water Pollution Control Federation

**EXPERIENCE**

Directed various programs associated with a groundwater remediation program for a major chemical industry. Project involves investigation and remediation of a total of 17 lagoons containing in excess of 400,000 tons of organic and inorganic sludges, and the upgrading of wastewater conveyance and primary treatment facilities. Work completed to-date includes: characterization of lagoon contents; evaluation of remedial alternatives for two lagoons; preparation of a feasibility study of the wastewater conveyance/primary treatment system; preparation of a feasibility study for four lagoons; preparation of a RCRA Part B permit application for a surface impoundment and the preparation of RCRA closure plans for three surface impoundments.

Directed the preparation of the Site Evaluation Submission required in accordance with New Jersey's ECRA for a total of twelve industrial sites in New Jersey. Representative sites include: a 20 acre machine parts manufacturing facility; a 20 acre chemical manufacturing facility and a 25 acre industrial wastewater treatment plant. Work efforts on these projects included negotiations with the NJDEP-ECRA personnel, providing input and working with client's counsel, the preparation of pre-ECRA assessments,



development of preliminary remedial cost estimates, the implementation of site sampling plans and the preparation of site assessment reports.

Directed evaluation of remedial actions for two lagoons containing 10 million gallons of sludges and tars from a coke distillation process. Remedial action alternatives investigated included in-place containment, incineration, recycle/reuse, solidification/fixation, landfilling, and in-place biodegradation. Selected remedial action was incineration for energy recovery. Selected remedial action entailed the blending of the contents of these lagoons into a No. 6 fuel oil type material for use as a fuel extender.

Directed design of demonstration scale facility for the blending of the contents of two lagoons into No. 6 like fuel oil material for use as a fuel extender. Demonstration scale facility included material handling and two stage blending. Blending facility was designed to produce a No. 6 fuel like material to establish viscosity and particle size criteria. Additionally, directed the preparation of contract documents and specifications for the closure of these lagoons. Specifications developed included excavation, waste handling, waste storage and lagoon closure.

Directed the remedial investigation/feasibility study conducted to address organic contamination of the local ground water system and wide spread soils contamination at a metal fabrication facility. Remedial action alternatives included ground water recovery and treatment system by air stripping and carbon adsorption, biodegradation off-site disposal risk assessment. Program currently underway.

Provided consulting services, associated with the review of RCRA compliance programs, to a number of industries. Directed the preparation of Part B permit applications for three storage facilities for a pharmaceutical manufacturer. Provided sampling and analytical services associated with RCRA waste streams and was responsible for development and updating of two RCRA Compliance Manuals, including procedures for handling hazardous waste, waste analysis plans for hazardous waste streams and closure plans for hazardous waste facilities. Prepared audio-visual personnel training program dealing with the RCRA regulations.

Developed Spill Prevention Control and Countermeasure Plans for four (4) industrial manufacturing sites incorporating RCRA requirements for hazardous substance storage and disposal.

Directed environmental audit for assessment of environmental regulatory compliance for a major chemical manufacturing facility, two (2) ink formulating facilities and two (2) cosmetic manufacturing facilities. Work efforts also included developing recommended compliance program.

Directed the feasibility study and final design of industrial wastewater treatment facilities for a phosphor manufacturing operation. Wastewater treatment processes evaluated included, chemical precipitation evaporation, filtration and ion exchange for the removal of heavy metals. Work efforts

included treatability testing, pilot testing, final design and negotiations with State and Federal agencies.

Directed evaluation of industrial/wastewater conveyance and treatment system. Conveyance and treatment system included a combined process/storm sewer system, pump station and primary treatment facilities. Evaluation included investigations into wastewater segregation, storm water handling and treatment, and sewer remediation.

Directed Sewer System Evaluation Survey encompassing 282 miles of separate sanitary sewers and 80 miles of storm drains. Technical evaluating hydraulic analysis of existing 400 ft. and 800 ft. inverted siphons, and evaluation of preliminary designs for alternative conveyance systems under existing harbor.

Provided construction review and design of required modifications for 0.7 mgd extended aeration, activated sludge plants.

#### PUBLICATIONS

Groundwater Migration of Rehabilitated Infiltration Sources. Presented at the 55th Annual Water Pollution Control Federation, October 1982.

#### A PARTIAL LISTING OF CLIENTS INCLUDE:

American Cyanamid Company  
CIBA-GEIGY Corporation  
E.I. DuPont de Nemours  
Rhone-Poulenc, Inc.  
Engelhard Corporation  
Reichhold Chemical, Inc.  
Morton Thiokol  
Singer  
Sandoz  
Coca-Cola  
General Motors  
Airco Industrial Gases

**SWIATOSLAV W. KACZMAR, Ph.D., C.I.H.  
MANAGER, ENVIRONMENTAL TOXICOLOGY**

**BACKGROUND**

Dr. Kaczmar joined O'Brien & Gere in 1983 and was promoted to the position of Manager of Environmental Toxicology and Industrial Hygiene in 1986. His function is the evaluation of the toxicology and environmental disposition of chemical and physical contaminants. He performs health hazard evaluations and risk assessments on hazardous waste sites, industrial discharges, chemical emergencies and occupational exposures to determine an appropriate level of response. Dr. Kaczmar is also the Director of the Firm's toxicological testing facility and asbestos laboratory, and is a Certified Industrial Hygienist. He has performed noted research on the distribution and fate of chlorinated dioxins in Michigan and is an accomplished trace residue chemist.

**EDUCATION**

Northern Michigan University, 1976, BS/Chemistry; Biology & Water Science

Michigan State University, 1979, MS/Chemical Limnology

Michigan State University, 1983, Ph.D./Environmental Toxicology

**PROFESSIONAL AFFILIATIONS**

American Chemical Society - Environmental Chemistry Section

American Society of Mechanical Engineers Committee on Dioxin Emissions  
from Resource Recovery Operations

Health Physics Society

M.S.U. Chapter, Society of Toxicology

Society for Risk Analysis

Society of Environmental Toxicology and Chemistry

American Industrial Hygiene Association

Air Pollution Control Association

Adjunct Assistant Professor - Syracuse University

Member-Review Committee - Standard Methods for the Examination of Water  
and Wastewater - 17th Edition

Chairman- Dioxin Methods Development Committee -

Standard Methods for the Examination of Water and Wastewater

**EXPERIENCE**

**ASBESTOS EVALUATION AND REMEDIATION PROGRAMS**

NIOSH Asbestos analysis proficiency program: Laboratory Director assuring the quality of determination of bulk and airborne asbestos samples.

EPA/RTI Quality Assurance Program: Laboratory Director assuring quality control for bulk sample analysis.

Supervision and oversight of the laboratory analytical program for bulk and air analysis for asbestos. Responsibilities include:

- In-house quality assurance/quality control program for asbestos sample analysis;
- NIOSH and EPA quality assurance programs;
- Internal quality control manual;
- Inter-laboratory exchange program;
- Data management system for storage, documentation and report generation;
- Design of asbestos laboratory specifications for proper ventilation and filtration requirements.

#### INDUSTRIAL HYGIENE

Corning Glass Works, Corning, NY. Provided oversight of glass kiln demolition and rebuilding. Reviewed safety and hygiene issues related to the OSHA lead and arsenic standards, heat stress, worker monitoring and safety training, personal protective equipment, construction of protective barriers and disposal of waste materials.

Corning Glass Works, Corning, NY. Design of a mobile personnel decontamination facility for use during the demolition and reconstruction of glass kilns.

Alcan Aluminum Company. Cryson Electronics, Phoenix, Arizona. Survey of gallium arsenide crystal growing facility for arsenic contamination.

Onondaga Community College, Syracuse, NY. Analysis of air samples in a classroom for residues of domestic use pesticides. Evaluation of ventilation system.

World Industries, Inc., Fulton, NY. Industrial hygiene survey of roll dryer unit. Evaluation of ventilation system.

Webster Elementary School, Syracuse, NY. Air monitoring for formaldehyde residues.

City of Syracuse Schools. Monthly air monitoring for nuisance dusts during construction and renovation of five school buildings.

Trans-Tech Industries, Adamstown, MD. Performed industrial hygiene audit of microwave component fabrication facility.

Eric Mower Company, Syracuse, NY. Conducted industrial hygiene audit and workplace sampling program of a printing and publishing facility.

Major Aircraft Component Manufacturer. - Conducted an industrial hygiene audit and workplace sampling.

American Cyanamid, Bound Brook, NJ. - Preparation of a Safety and Health Plan for excavation and disposal activities from a series of chemical waste lagoons. Included preparation of a videotaped Safety Training program.

Major Aircraft Component Manufacturer. - Conducted an industrial hygiene audit and workplace sampling.

Conducted research into the photolysis of 2,3,7,8-TCDD adsorbed to soil surfaces.

Michigan State University - Performed trace analyses outlining the geographic distribution of part-per-trillion residues of 2,3,7,8-tetrachlorodibenzo-p-dioxin in Michigan fishes.

- Developed an in vitro technique for predicting the volatilization rates of trihalomethanes from rivers and streams.
- Synthesized all 22 tetrachlorodibenzo-p-dioxin isomers. Conducted investigations into the photodegradation rates of various chlorinated dioxin congeners.
- Performed a structure-activity assay on the 22 tetrachlorinated dioxin isomers by monitoring their ability to induce rat hepatic mixed function oxidase systems.
- Evaluated the synergistic effects of polybrominated biphenyls on renal injury induced by cephalosporins.

#### PCB, DIOXIN and DIBENZOFURAN ACTIVITIES

Niagara Mohawk Power Corp., Syracuse, NY - Provided lead in interpretation of GC/MS data and risk assessment of potential dioxin and dibenzofuran residues following an electrical transformer explosion

Neal's Landfill, Bloomington, IN Evaluation of potential transport, fate and potential toxic effects of PCB contamination at a major Superfund site. Observation and review of government contractor activities. Evaluated potential remedial options, including on-site incineration. Activities on behalf of PRP.

Ludlow Sanitary Landfill, Paris, NY. Prepared a human health and environmental risk assessment at a New York State Superfund site on behalf of the PRP group. The site was a mixed waste municipal landfill with PCB-containing wastes. Assessment involved modelling of human exposures as well as evaluation of potential impacts to a designated wetland area.

Rasmussen Landfill, Green Oak Township, MI. USEPA Superfund site. Review of PCB, dioxin and dibenzofuran residues in a mixed waste landfill following a major fire in the landfill. Investigation performed as a review of USEPA contractor activities on behalf of PRP group. Activities included

evaluation of residue dynamics, potential risks and feasible remedial options.

Sangamo Electric Corp., Marion IL. - Risk Assessment on behalf Sangamo Electric of potential human health and environmental impacts of PCB contamination in a manufacturing facility and an adjacent industrial landfill. Assessment included evaluation of potential remedial options.

Times Beach, MO Review of government contractor activities investigating the presence and distribution of dioxins in a residential area. Work conducted on behalf of PRP group. Activities included review of field investigations, risk assessment and feasibility study of remedial alternatives. Alternatives evaluated included incineration of contaminated soils in a mobile on-site as well as off-site incinerator.

Environmental Protection Agency, Dioxin Contract Laboratory Program - Provides lead in coordinating analytical efforts and data evaluation of environmental samples analyzed for dioxins under the Superfund Program.

Metropolitan Water Board, Onondaga Co., NY - Interpretation of GC/MS data and human health assessment of water from Lake Ontario analyzed for 2,3,7,8-TCDD.

New York State Energy Research and Development Authority, Albany, NY. - Participated as a member of the Pittsfield Incinerator Research Project to evaluate the formation of dioxins and dibenzofurans in a municipal waste resource recovery facility under various temperature and operating conditions. Provided backup analytical support for analytical measurements.

American Society of Testing Materials/American Society of Mechanical Engineers. - Participated in the design and writing of a standardized analytical protocol for the analysis of chlorinated dioxins and dibenzofurans in samples of stack emissions from waste incinerators collected using the USEPA Method 5 sampling train.

Adirondack Resource Recovery Corporation - Acted as a consultant and expert witness on the formation and potential human health effects of potential chlorinated dioxins and dibenzofuran emissions from a municipal resource recovery facility. Reviewed and provided comment on existing air pollution control designs and Environmental Impact Studies.

Amchem Corporation, Ambler, PA. Preparation of a dioxin sampling plan at a railroad siding where chlorophenoxy herbicides were loaded.

#### **CERCLA ACTIVITIES: RISK ASSESSMENTS and FIELD INVESTIGATIONS**

Cliffs-Dow site, Marquette, Michigan. USEPA Superfund site. Managed the overall Remedial Investigation/Feasibility Study on behalf of the PRP group. Prepared a human health and environmental risk assessment on the information generated during the remedial investigation and provided evaluation of remedial options.

**Spiegelberg Site, Green Oak Township, MI. USEPA Superfund Site.** Designed and directed a field study independent of USEPA efforts in support of PRP interests to generate data for a risk evaluation of a paint sludge disposal area. Conducted test pit investigation to determine the nature and volume of waste materials.

**Baird and McGuire Site, Holbrook, MA. USEPA Superfund Site.** Provided oversight of field activities and critique of a risk assessment at an inactive pesticide and household chemical formulating facility on behalf of PRP.

**Major Pesticide Manufacturing Facility** - Prepared a risk assessment of an uncontrolled pesticide manufacturing waste landfill with releases to an adjacent estuary on behalf of the PRP. Utilized chemical measurements, bioassays and tidal dilution modelling to quantify the degree of potential impacts to the estuarine system.

**Major Electronics Manufacturer** - Prepared a toxicological risk assessment of potential releases from a waste landfill containing heavy metal and organic solvent wastes on behalf of the PRP.

**Ludlow Sanitary Landfill, Paris, NY.** Prepared a human health and environmental risk assessment at a New York State Superfund site on behalf of the PRP group. The site was a mixed waste municipal landfill with PCB- containing wastes. Assessment involved modelling of human exposures as well as evaluation of potential impacts to a designated wetland area.

**Moyer's Landfill, Philadelphia, PA.** - Conducted a review of a Remedial Investigation/Feasibility Study document prepared by a Superfund Contractor and formulated an independent preliminary risk assessment on behalf of PRP group.

**Peter Cooper Corporation, Gowanda, NY** - Risk assessment on behalf of PRP at two riverside sites used for the disposal of tannery wastes containing chromium.

**Town of Conklin, NY. Municipal Waste Landfill** - Risk assessment on behalf of PRP of a former mixed waste municipal landfill adjacent to a designated wetland.

**City of Niagara Falls, NY** - Consultation and preparation of a report outlining the economic and toxicological impact of the proposed "S" Area Settlement Agreement, which involved the City of Niagara Falls, Hooker Chemical Co., the USEPA and the New York State Department of Environmental Conservation. Project included discussions with legal advisors, regulatory agencies and City officials, and resulted in detailed estimates for costs to the City from the settlement.

**Niagara Mohawk Power Corporation, Syracuse, NY.** Hazard ranking on behalf of PRP at two uncontrolled waste sites situated on the Niagara River.

**PPG Corporation, Barberton, OH** - Risk assessment of eight inactive waste lagoons/landfills and a surface impoundment used for the disposal of Solvay Process and solvent production wastes.

Syracuse University, Syracuse, NY - Human health risk assessment of chromium contamination of drinking water system.

Crab Orchard National Wildlife Refuge, Marion, IL - Risk assessment on behalf of the United States Department of Interior of twelve army munitions loading and storage sites within the Wildlife refuge for potential human health and environmental impacts.

Sangamo Electric Corp., Marion IL. - Risk Assessment on behalf Sangamo Electric of potential human health and environmental impacts of PCB contamination in a manufacturing facility and an adjacent industrial landfill. Assessment included evaluation of potential remedial options.

Wyman Gordon Corporation. Risk assessment on behalf of PRP of groundwater contamination by arsenic.

TRW Corporation. Numerous Locations - Prepared human health and environmental risk assessments of releases from underground storage tanks under national contract between TRW Corporation and O'Brien And Gere Engineers, Inc.

NL Industries. Four Locations. Provided human health and environmental risk assessments of lead smelting operations at three secondary lead smelting operations and one waste landfill.

#### EXPERT WITNESS AND LITIGATIVE SUPPORT

Most of the risk assessment and field investigation activities presented above involved the preparation of documents for future or potential litigation. The following activities represent projects which involved a greater degree of involvement with PRP counsel. As such, the law firms for which the activities were conducted are listed.

Beveridge and Diamond, Washington, D.C. - Conducted field investigations and risk assessments at uncontrolled hazardous waste sites on behalf of industrial clients.

Dickinson, Wright, VanDusen and Freeman, Detroit, MI. Conducted risk assessment and field investigations on behalf of a major automobile manufacturer. Served as expert witness under affidavit for pending litigation. Obtained and reviewed information under the Michigan Freedom of Information Act. Provided major review and comprehensive critique of Risk Assessment and Phased Feasibility Study prepared by USEPA contractor. The field activities and critique were prepared under an extremely fast track during the public comment period as the primary basis for future litigative defense.

Jones, Day, Reavis and Pogue, Cleveland, OH. - Neal's Landfill Superfund site. Provided evaluation of environmental impacts related to contamination by PCBs on behalf of a major electronics manufacturer.

Nixon, Hargrave, Devans and Doyle, Rochester, NY. Provided expert testimony as an affidavit for defense against a class action citizen's suit for discharge permit violations.



Bond, Schoeneck and King, Syracuse, NY. Provided technical support and evaluations of hazardous waste releases for industrial clients.

Lewis and Rice, St. Louis, MO. Provided technical support review and evaluations of a major Superfund investigation on behalf of PRP group.

#### HAZARDOUS WASTE MANAGEMENT

Pennwalt Corporation, Calvert City, KY - Preparation of a RCRA Exposure Assessment of a gypsum and lime waste production landfill and two lagoons.

Spiegelberg Landfill, Green Oak Township, Mi. Managed the characterization and disposal of liquid and solidified paint sludge excavated from a waste landfill. Disposal arrangements included incineration of liquids and secure landfilling of solids.

IBM Corporation, Endicott, NY. Prepared a RCRA exposure assessment of a permitted wastewater surface impoundment.

FMC Corporation, Baltimore, MD. Prepared a RCRA exposure assessment of a permitted containment lagoon and spillway.

Union Carbide, South Charleston, WV - Provided technical and regulatory assistance in support of client's efforts to establish a RCRA Alternate Concentration Limit (ACL) for ethylene production wastes at an ethylene plant in Ponce, Puerto Rico.

Union Carbide, South Charleston, WV. Provided technical and regulatory support for the demonstration of a no adverse impact zone in a bay around a manufacturing facility. Activity involved the evaluation and critique of internal documents presenting the results of surface water modeling, chemical fate evaluation and toxicological risk assessment.

City of Jamestown, NY. Decommissioning of an inactive chemistry laboratory. Involved regulatory evaluation, waste characterization, packaging, manifesting and disposal.

#### AQUATIC TOXICOLOGY

Implemented and currently directs the operation of an in-house toxicological testing facility performing routine and non-routine aquatic bioassays.

Armstrong World Industries, Fulton, NY Performed a series of acute aquatic bioassays using fathead minnows and Daphnia to characterize potential aquatic impacts of each aqueous waste stream in the facility. Reviewed raw materials and products to identify potentially toxic components.

IBM Corporation, East Fishkill, NY. Conducted acute bioassays using fathead minnows and Daphnia magna as well as chronic fathead minnow and Ceriodaphnia bioassays on wastewater effluent as part of a discharge permit requirement.

IBM Corporation, Essex Junction, NY. Conducted aquatic bioassays on wastewater effluent using fathead minnows, *Daphnia magna* and *Selenastrum capricornutum*. Prepared a wastewater biomonitoring plan for the facility.

City of Schenectady, NY - Performed an acute and chronic aquatic bioassay on municipal wastewater effluent as part of a discharge permit requirement.

City of Rome, NY - Performs an ongoing quarterly acute aquatic bioassay on a permitted municipal wastewater discharge.

Amphenol Products, Sidney NY. Quarterly aquatic bioassay testing of a permitted industrial wastewater discharge.

Friend Laboratories, Waverly, NY Acted as a subcontractor for aquatic bioassay services.

Pesticide Manufacturing Facility, Inactive Waste Landfill. Performed acute saltwater bioassays using ghost shrimp and sheepshead minnows on groundwater discharging to an adjacent estuary to provide quantitative data in support of an environmental risk assessment.

Major manufacturing facility. Used bioassays to evaluate the efficiency of ozone treatment of waste to reduce effluent toxicity.

#### PUBLICATIONS AND PAPERS PRESENTED

Kaczmar, S.W., Zabik, M.J. and D'Itri, F.M., Occurrence and behavior of halomethanes in the aquatic environment. Submitted to Environmental Management.

Kaczmar, S.W., Zabik, M.J. and D'Itri, F.M., Aqueous volatilization of selected haloforms. Env. Tox. and Chem. 3:31-5. 1984

Kaczmar, S.W., Zabik, M.J. and F.M. D'Itri. Part per trillion determination of 2,3,7,8-TCDD in Michigan fish. To appear in Chlorinated Dioxins and Dibenzofurans in the Total Environment. L.H. Keith and G. Choudhary, ed. Ann Arbor Science, 1984.

Kaczmar, S.W., Mass balance of C<sub>10</sub>H<sub>16</sub> 442 in the Adrian, Mich. sludge landfill. Report to the Michigan Toxic Substance Control Commission.

Occurrence and behavior of haloforms in the aquatic environment. A poster presented at the first national meeting of the Society of Environmental Toxicology and Chemistry. Washington, D.C. November 1980.

A method for measuring the aqueous volatilization rates of hydrophobic organic materials. Third Midwest Water Chemistry Workshop. Ann Arbor, Michigan. February 1981.

Occurrence and behavior of haloforms in the aquatic environment. Poster presented at the first "Toxicology in Michigan Today" Conference. East Lansing, Michigan. April 1981.

Haloforms in Natural Waters. Michigan State University Fisheries and Wildlife Seminar Series. May, 1981.

Quality Control Techniques Used in Dioxin Analysis at the Part Per Trillion Level. Michigan State University Pesticide Research Center Annual Conference. July 1981.

Synthesis and Identification of the 22 Congeners of TCDD. Michigan State University Pesticide Research Center Annual Conference. May 1982.

Rat Hepatic Enzyme Induction by Various Congeners of TCDD. Poster presented at the 2nd "Toxicology in Michigan Today" Conference. East Lansing, Michigan. June 1982.

The Extent and Geographic Distribution of 2,3,7,8-Tetrachlorodibenzo-p-dioxin Residues in Michigan. Paper presented at the 1983 Conference of the International Association of Great Lakes Research. Oswego, NY. May 25, 1983.

Part Per Trillion Determination of 2,3,7,8-TCDD in Michigan Fish. Paper presented at the fall 1983 meeting of the American Chemical Society. Washington, D.C. August 29, 1983.

Invited participant in a workshop on Sampling and Analytical Techniques during the "Dioxins in the Environment" symposium held at Michigan State University, East Lansing, MI. December 6-7, 1983.

Structure-Activity Studies on Enzyme Induction by Various TCDD Congeners. Poster presented at the 4th annual meeting of the Society of Environmental Toxicology and Chemistry held in Washington, D.C. November 6-9, 1983.

Invited participant in workshop for the development of Standard Methods for Sampling, Analysis, and Monitoring of Municipal Incinerators for the Emission of Chlorinated Dioxins, Dibenzofurans and Related Compounds. Sponsored by the U.S. D.O.E., Argonne National Laboratory, Washington D.C. January 23-27, 1984.

Significance of Environmental Concentrations of Dioxins in Fish, Water and Sediment: Invited presentation at the 8th Symposium on Aquatic Toxicology. American Society of Testing Materials. April 17, 1984. Fort Mitchell, KY.

Human Health Impacts of Chlorinated Dioxins from Resource Recovery Operations. Invited speaker at the Eleventh Bi-Annual meeting of the Solid Waste Processing Division, American Society of Mechanical Engineers. Orlando, Florida. May 1984.

Human Health Impacts of Resource Recovery. Featured speaker at the Annual Meeting of the Northeast States for Coordinated Air Use Management (NESCAUM). August 14, 1984, Sturbridge, MA.

What is the Level of Risk to Humans from Dioxin? Featured speaker at the Fall, 1984 Resource Recovery Workshop of the Institute of Resource Recovery. October 16, 1984, New York, NY.

Site Assessment Under CERCLA: "The Importance of Distinguishing Hazard from Risk". Paper presented at the 5th National Conference on Management of Uncontrolled Hazardous Waste Sites. November 8, 1984, Washington, DC.

Photolytic Destruction of 2,3,7,8-TCDD Adsorbed to Soil Surfaces. . Platform paper presented at the 5th annual meeting of the Society of Environmental Toxicology and Chemistry. November 6, 1984, Washington, DC.

DAVID R. HILL  
GENERAL MANAGER  
OBG LABORATORIES, INC.

#### BACKGROUND

Mr. Hill joined O'Brien & Gere in 1971 and was promoted to Manager of Analytical Services in 1981. In 1985, he became General Manager of OBG Laboratories, Inc. He provides technical expertise and management of projects involving the following areas: hazardous waste analytical protocol development; chain of custody; QA/QC; analysis of water and wastewater; and gas chromatographic analysis of organic compounds.

#### EDUCATION

Clarkson University, 1971, BS/Chemistry  
Syracuse University, 1979, MS/Sanitary Science

#### PROFESSIONAL AFFILIATIONS

American Chemical Society

American Water Works Association

Member, Subcommittee on Phosphorus, Standard Methods for the Examination of Water and Wastewater, 16th edition.

Member, Subcommittee on Method 514, Purge and Trap and Method 506, TOX Standard Methods for the Examination of Water and Wastewater, 17th edition (in preparation).

#### EXPERIENCE

Responsible for financial and market efforts of analytical services; also for the supervision, coordination, scheduling and evaluation of data analyzed by a 20 member staff.

Mr. Hill's experience includes the supervision of projects dealing with the following: Organic characterization of a chemical waste pond for a chemical manufacturer; a ground water monitoring program for the analysis of hazardous wastes, volatile halogenated organics and aromatic hydrocarbons for a major manufacturer; analytical programs to support RCRA compliance; provision of analytical support for the identification of hazardous waste material for a metal manufacturer; and analysis of water, sediment and biological tissue samples for PCBs.

Supervision of analytical services which include the following capabilities; gas chromatography/mass spectroscopy, automated instrumentation, microbiology, virology, atomic absorption, wet chemistry, specific ion electrode chemistry, NMR, ESR, quality control, methods development, infrared and ultraviolet spectroscopy, X-ray crystallography, electron microscopy; interpretation and review of analytical results; oversee a co-op program with area community colleges; oversee analysis of drinking water, wastewater, and industrial effluents; assist in the design of a computerbased laboratory data system; quantitative and qualitative analysis of chlorinated hydrocarbons; fingerprinting organics via liquid partitioning and gas

chromatographic analysis; proficient in analytical techniques for wastewater analysis.

In addition, he has directed the following specific projects:

Confidential - Ground water monitoring program to assess the extent of volatile halogenated organic contamination. Generation of 40-60 samples per week for three years.

USEPA - Supervise a contract laboratory program (CLP) for the analysis of dioxin samples from throughout the US.

Sangamo Weston, Inc. - Oversee the analytical portion of a remedial investigation at a USEPA Superfund site. Program generated over 500 samples for priority pollutants and dioxin analysis.

Schenectady Chemical, Schenectady, NY - Oversee analytical program for RCRA Part B permitting documentation.

Harter Secrest & Emery Attorneys, Rochester, NY - Direct analytical program in response to state marshall's investigation of alleged improper hazardous waste disposal.

New York State Department of Environmental Conservation - Spill prevention program - involves the fingerprinting of petroleum products in surface waters and potable water supplies to determine the possible source.

Confidential - Oversee hazardous waste analytical program which is on New York State Superfund list. Initially, indicator parameter will be analyzed to determine extent of contamination followed by more extensive characterization of soil and ground water from the site.

Department of Environmental Conservation, Syracuse, NY - Characterization of hazardous waste at fire demolition site. Immediate response needed due to public health concern.

Department of Environmental Conservation, Waterford Pilot Plant, Albany, NY - Analysis of water samples from the pilot plant for the treatment of halogenated organics, including PCBs, using granular activated carbon, macroreticular resins and filtration.

Monsanto Company - Collaborative testing program for evaluation of methods to analyze purgeable halogenated aliphatic and aromatic hydrocarbons. Methods 601, 602, 501.1 and 501.2.

Southwest Research Institute - Collaborative testing program for evaluation of methods for phthalate ester compounds. Method 606.

Onondaga County, NY - Combined sewer overflow characterization analysis; Onondaga Lake and Creek Monitoring analysis; Onondaga County Industrial Waste Study Analysis.

MANUSCRIPTS

Evaluation of New York Bight Lobsters for PCBs, DDT, Petroleum Hydrocarbons, Mercury and Cadmium. Hill, David R., Roberts, Alan E., Tifft, Edwin C. Jr., Bulletin of Environmental Contaminations and Toxicology 29, 711-718 (1982).

Studies of Certain Inorganic Nutrients in Cazenovia Lake. (Thesis) Hill, David R., Syracuse University, December 1979.

PUBLICATIONS

Characterization of Industrial Wastes by Evaluating BOD, COD and TOC. Hill, David R., Spiegel, Stuart J., Journal Water Pollution Control Federation, Vol. 52II, November 1980.

Loss of Polychlorinated Biphenyl Homologues During Chromium Trioxide Extraction of Fish Tissue. Hill, David R., Spiegel, Stuart J., Szelewski, Michael J., Tifft, Edwin C., Jr., Analytical Chemistry, 51:14, December 1979.

BOD, TOC and COD in Industrial Wastes. Hill, David R., Spiegel, Stuart J., Industrial Wastes, 21, November/December 1979.

A General Nutrient Evaluation of Cazenovia Lake. Hill, David R., 1977, (Lake Report 2), p. 80-88, Effler, S.W., Rand, M.E. (eds) Cazenovia Lake Study, 1 - Initiation Department of Civil Engineering, Syracuse University.

DONALD R. BRONDOU  
WET CHEMISTRY GROUP LEADER  
OBG LABORATORIES, INC.

#### BACKGROUND

Mr. Brondou joined the Firm in 1969 as a field technician. He entered the laboratory in 1972 and was promoted to Chemist in 1975. After serving as Quality Control Officer for the laboratory he became a Senior Chemist in 1980. He presently serves as group leader for the laboratory's Wet Chemistry Section.

#### EDUCATION

State University College of New York at Morrisville, 1969 AS/Water Resource Management

#### EXPERIENCE

As manager of the laboratory's Wet Chemistry Section Mr. Brondou is responsible for the supervision of a staff of six chemists and technicians, coordination of analytical activities, review and reporting of analytical data.

Various projects have provided experience with limnological studies, public drinking water analysis, ground water monitoring programs, and hazardous waste analysis.

#### PROJECTS

Westchester County, NY - Industrial pretreatment study. Two-year program involving analysis of industrial waste streams, sanitary influents, sanitary effluents, and sludges to determine the source and impact of toxic chemicals on several sewage treatment plants.

Special Metals Corp. - Investigation of sanitary landfill for potential hazardous waste contamination. The study involved analysis of soil borings and ground water samples for full priority pollutants.

Remington Arms Co. - Ongoing program involving SPDES permit testing and analysis of ground water from hazardous waste location.

Sangamo-Weston, Inc. - Hazardous waste investigation involving the analysis of 500 sediment samples collected at a USEPA Superfund site.

PPG Industries, OH - Hydrogeologic study of several sites to provide data for waste disposal site assessment.

Occidental Chemical Corp. - Analysis of ground water samples from landfill containing hazardous wastes. All work was done under CLP protocol.



**Page 2**

**Donald R. Brondou, Cont'd.**

**Woodward Clyde Consultants - Ground water investigation of a hazardous waste site. Services included analysis for mercury, TOX, TOC, TKN and phosphorous. Contract laboratory protocol was followed.**

A. ROBERT MARTIN  
TRACE ORGANICS  
GROUP LEADER  
OBG LABORATORIES, INC.

#### BACKGROUND

Mr. Martin joined the Firm in 1982 after working for seven years in the field of analytical chemistry. His area of expertise is the gas chromatographic analysis of environmental and industrial waste matrices for volatile and semi-volatile organic compounds.

#### EDUCATION

Northeastern University, 1977, BA/Biology

#### EXPERIENCE

As manager of the trace organics laboratory, Mr. Martin's responsibilities include the supervision of seven chemists and technicians, the coordination of analytical activities, the development of analytical methodologies, and the presentation of results.

Mr. Martin's experience has included the direction of a water chemistry laboratory whose capabilities included trace metals, trace organics, conventional pollutants and microbiology. Typical analytical programs included the measurement of waste treatment performance, the determination of toxic shock in waste treatment plants and the determination of the degree of lake deterioration in New York State.

Between 1978 and 1980 Mr. Martin directed a gas chromatography laboratory in Virginia. Under his direction the laboratory expanded from a three instrument operation to a seven instrument operation which included a staff of six chemists. Typical programs included: the monitoring of sediment and water samples from across the country for organochlorine pesticides and triazine herbicides, the measurement of PCBs in oils, sludges, soils and water collected under PCB compliance programs, and the validation of analytical methods for the measurement of PCBs in transformer oil, hydraulic fluids, capacitor fluids and waste oils.

Mr. Martin currently manages the following programs:

Major Electronics Manufacturer - Using EPA 601 and 602, the trace organics laboratory has analyzed over 10,000 samples for volatile organics. Samples are collected weekly from ground water monitoring wells, process wastewater sites, activated carbon treatment systems and air stripping treatment systems.

Major Electronics Manufacturer - Monthly, quarterly and semi-annual monitoring of ground water wells in connection with the Resource Conservation and Recovery Act (RCRA).

**Alcan Aluminum Corp. - Analysis of process water, oils and sediments for PCB compliance programs.**

**Dow Chemical Corp. - Landfill investigation using EPA methods 601, 602, 604 and 610. Multiple core samples and water samples were analyzed using capillary chromatography techniques.**

**Limnotech - Paper mill landfill investigation for PCBs to the part per trillion level. Samples of fish, sediment, landfill leachates and ground water wells were analyzed to measure the extent of the contamination.**

**Department of Environmental Conservation - Provide sampling and analytical services for the oil spill response program. Laboratory services include fuel oil identification, ground water and soil testing for petroleum products.**

**Special Metals Corp. - Sanitary landfill investigation for potential hazardous waste contamination. Surveys included PCB testing, volatile organic testing and full priority pollutants.**

**Monsanto Company - Provide analytical services for a ground water remediation program. Services included priority pollutants, total organic halogens and formaldehyde testing.**

**Cornell University - Provide laboratory services in connection with a landfill investigation program. Services included full priority pollutants, volatile organics and phenols.**



DONALD F. SCHUTZ, Ph. D.

President

Dr. Schutz is President of Teledyne Isotopes in which capacity he has overall responsibility for products, services and research in environmental radioactivity monitoring, thermoluminescent dosimetry, sodium iodide crystal manufacture, radiological waste disposal, nuclear fuel analysis, geochronometry and isotope geochemistry. He is the Chairman of the Radiation Safety Committee and is responsible for the Quality Assurance Program of the company.

From 1970 to 1975 Dr. Schutz was Vice President of the company and from 1968 to 1970 he was Manager of the Nuclear Geochemistry Department with responsibility for projects carried out for the Defense Advanced Research Projects Agency (DARPA), the Arms Control and Disarmament Agency (ACDA), and the Atomic Energy Commission for the study of radioactive products of atmospheric and underground nuclear explosions in the environment. His responsibilities ranged from laboratory studies to engineering development of sampling and detection systems. He participated in, and directed numerous field operations at the Nevada Test Site and at various off-site nuclear test areas. Dr. Schutz was principal investigator on projects sponsored by the National Uranium Resource Evaluation Program (NURE) of the Department of Energy. The projects were concerned with exploration for uranium ore deposits by use of radon and other gases produced by Uranium decay. He also did computer modelling studies of river basin pollution for the U.S. Environmental Protection Agency and the Division of Water Resources, NJ Department of Environmental Protection.

Prior to joining Teledyne Isotopes in 1964, Dr. Schutz was a Research Staff Geologist in the Department of Geology at Yale University where he received his Ph.D. degree in geology and geochemistry. He was primarily concerned with the determination of trace elements in seawater and stream water by neutron activation analysis. The techniques developed were applied to a worldwide sampling of seawater which included samples taken by Dr. Schutz in the Antarctic during the summer of 1963-1964. At Rice University Dr. Schutz received the M.A. in geology in 1958 and he received the B.S. (cum laude) in Geology from Yale University in 1956.

Professional and technical memberships include Sigma Xi, Geochemical Society, Geological Society of America, American Geophysical Union, American Nuclear Society, Society of Petroleum Engineers of A.I.M.E., Society of Petroleum Exploration, American Association of Petroleum Geologists, Energy Minerals Division of AAPG, Air Pollution Control Association, Atomic Industrial Forum, American Public Health Association (Radiation Health Section), Scientists & Engineers for Secure Energy, and the Health Physics Society (Environmental Radiation Section).

Dr. Schutz served on a Task Advisory Group Decommissioning of the Plum Brook Reactor Facility and participated in a geothermal energy technical exchange mission to the Tibet Autonomous Region and Yurmon Province of the Peoples Republic of China. He is a member of the NJ DEP Low Level Radioactive Waste Advisory Committee, and is Chairman of the NJBIA Ad Hoc Committee on Low-Level Radioactive Materials. Dr. Schutz is President of the American Association of Radon Scientists and Technologists.

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JOHN DAVID MARTIN, Ph. D.

Vice President - Technical  
Manager, Environmental Analysis Department

Dr. Martin is Vice President - Technical, of Teledyne Isotopes and Manager of the Environmental Analysis Department. He is responsible for the overall management of the radiological environmental monitoring programs, reactor in-plant programs, and bioassay programs for nuclear power facilities. The Environmental Analysis Department is composed of four laboratories, Radiochemistry, Gamma-ray Spectroscopy, Tritium, and Gas Analysis, which perform analyses for nuclear power facilities. Dr. Martin's responsibilities also include management of the Radiocarbon Laboratory, TeleTrace operations, and environmental TLD Service. The Radiocarbon Laboratory provides commercial dating services for archeologists, universities, museums, and other geotechnical organizations throughout the world. TeleTrace Services, which involve the use of radioisotopic tracers in enhanced recovery projects, are used by the oil industry throughout the United States and in foreign countries.

Prior to assuming his present position in 1974, Dr. Martin directed and participated in the research and development of various nuclear instrumentation counting systems under Government contracts at Teledyne Isotopes. Included was the development of a low background gas proportional spectrometry system for conducting measurements of gaseous radionuclides produced by cosmic ray interactions in the troposphere.

Prior to his joining Teledyne Isotopes in 1970, Dr. Martin was a physicist at the McClellan Central Laboratory, McClellan AFB, California. In that capacity he assisted in the development of new techniques for measuring the radioactivity of various elements. Emphasis was on the gaseous elements using liquid scintillation and solid state detection systems.

From 1963 to 1967 Dr. Martin was at the University of Florida where he conducted research which was concluded with a dissertation entitled: "Experimental Investigations of Negative Ion Collisions: Electron Detachment and Ion-Molecule Reactions".

Prior to his dissertation research, Dr. Martin was engaged in investigations at the National Aeronautics and Space Administration, Langley Research Center, involving an atmospheric light scattering experiment for the purpose of determining the molecular number density as a function of height above the surface of the earth.

Dr. Martin received a B.S. in Physics from Virginia Military Institute in 1961, a M.A. from the College of William and Mary in 1963, and a Ph. D. in Physics from the University of Florida in 1967.

The author of a number of scientific publications in the field of atmospheric physics, Dr. Martin is a member of the American Physical Society and Sigma Pi Sigma.

**R e s u m e**

**HELEN G. KING. B.A.**

**Quality Assurance Manager/  
Senior Scientist**

Ms. King is the Quality Assurance Manager at Teledyne Isotopes. She is authorized by management to develop and implement quality assurance procedures for the technical operations of the company. In addition, she reviews the results of analysis from the Environmental Analysis Department to insure continuing quality performance. Regular audits are conducted of all departments to assure compliance with the applicable NRC regulations.

Prior to her promotion to Manager of Quality Assurance, Ms. King was a Senior Assistant Scientist in the Radiochemistry Laboratory of the Environmental Analysis Department. She performed radiometric determinations of sample activities using nuclear instrumentation and performed data computations using a calculator programmed for specific radionuclides.

Ms. King has had prior experience in laboratory analysis, first as a research associate at Bell Telephone Laboratories working with relay switching systems for ten years, and then in preparation of tissue sections from test rats in the Toxicology Department at Lever Brothers.

She has also had eight years of teaching experience at Dwight School in Englewood, New Jersey, where she taught 12th grade physics and 7th grade general science.

Ms. King received a B.A. degree in Chemistry from Hunter College. She has done graduate work towards an M.A. degree at Fairleigh Dickinson University, including a course in fortran computer programming.

APPENDIX L  
LEACHATE SAMPLING PROTOCOL

### LEACHATE SAMPLING PROTOCOL

The following procedures are to be utilized in sampling the landfill leachate sumps:

- a. Identify sampling location;
- b. Complete a site description form, presented as Figure 10;
- c. Put on a new pair of disposable gloves;
- d. Place a clean length of Tygon<sup>R</sup> tubing into the leachate sump access pipe;
- e. Attach the tubing to an appropriate peristaltic or vacuum pump;
- f. Initiate pumping of the leachate;
- g. Collect leachate in labelled, clean sample containers;
- h. Upon collection, preserve as necessary;
- i. After last sample for laboratory analysis has been collected, collect additional leachate in a 200 ml beaker and measure and record the pH. Pour the leachate from the 200 ml beaker back into the leachate sump access pipe;
- j. Store sample containers at 4°C in a covered container.



APPENDIX M  
MONITORING WELL INSTALLATION PROTOCOL

## OVERBURDEN DRILLING/SAMPLING PROTOCOL FOR SHALLOW MONITORING WELL COMPLETION

### I. Drilling/Sampling Procedures

Test borings shall be completed using the hollow stem auger drilling method or rotary drilling method to a depth specified by the supervising geologist/engineer. Hollow stem auger drilling method is preferred.

If a hollow stem auger drilling method is to be utilized for 4-inch diameter monitoring well completion, the minimum inside diameter of the augers shall be 6 inches.

Samples of the encountered subsurface materials shall be collected at a minimum of every five (5) feet and/or change in material or at the discretion of the supervising geologist. The sampling method employed shall be ASTM Method D-1586-67/Split Barrel Sampling using either a standard 2 ft. long, 2 in. outside diameter split spoon sampler with a 140 lb. hammer or a 3 in. outside diameter sampler with a 300 lb. hammer. Upon retrieval of the sampling barrel, the collected sample shall be placed in glass jars and labelled, stored on site (on ice in a cooler if necessary), and transmitted to the appropriate testing laboratory or storage facility. Soil samples should be taken from the center portion of the split spoon to minimize contact contamination.

A geologist will be on site during the drilling operations to fully describe each soil sample including 1) Soil type, 2) color, 3) percent recovery, 4) moisture content, 5) odor and 6) miscellaneous observations such as organic content. The supervising geologist will be responsible for retaining a representative portion of each sample in a one pint glass jar labelled with 1) site, 2) boring number 3) interval sample/interval preserved, 4) date, and 5) time of sample collection.

The drilling contractor will be responsible for obtaining accurate and representative samples, informing the supervising geologist of changes in drilling pressure, keeping a separate general log of soils encountered including blow counts (i.e. the number of blows from a soil sampling drive weight (140 pounds) required to drive the split spoon sampler in 6-inch increments and installing monitoring wells to levels directed by the supervising geologist following specifications further outlined in this protocol.

### II. Monitoring Well Completion

All monitoring wells will be constructed of flush-joint, threaded, schedule 40 PVC well screen and riser casing. The riser casing will extend from the screened interval to approximately two feet above existing grade. The screen will be 10 ft. in length with a slot size of 0.020 inches. Other materials utilized for completion will be washed graded silica sand (Morie #00, Ottawa #3 or equivalent), bentonite, Portland Cement and a protective steel locking well casing and vented cap with locks.

The monitoring well installation method for 4-inch wells installed within unconsolidated sediments shall be to place the screen and riser assembly into the casing once the screen interval has been selected. At that time a washed silica sand pack will be placed around the well screen if required to prevent screen plugging. If a sand pack is not warranted, the auger string will be pulled back to allow the native aquifer material to collapse 2-3' above the top of the screen. A minimum of 2 ft. of Bentonite pellets will then be added to the annulus between the casing and the inside auger to insure proper sealing. Cement/Bentonite grout will be added during the extraction of the augers until the entire aquifer thickness has been sufficiently sealed off from horizontal and/or vertical flow above the screened interval. All sealants with the exception of the bentonite pellet seal will be emplaced with a tremie pipe. During placement of sand and bentonite pellets frequent measurements will be made to check the height of the sand pack and thickness of bentonite layers by a weighted drop tape measure. A sample of bentonite will be retained for possible testing.

A vented protective steel casing shall be located over the PVC standpipe extending 2 ft. below grade and 2-3 ft. above grade secured by a Portland Cement seal. The cement seal shall extend laterally at least 1 ft. in all directions from the protective casing and shall slope gently away to drain water away from the well. A vented steel cap will be fitted on the protective casing. The cap shall be constructed so it may be secured with a steel lock.

A typical monitoring well detail is attached. The supervising geologist shall specify the monitoring well design to the Drilling Contractor before installation.

## OVERBURDEN DRILLING/SAMPLING PROTOCOL FOR DOUBLE CASED MONITORING WELL COMPLETION

### I. Drilling/Sampling Procedures

Test borings shall be completed using conventional fluid or air rotary drilling methods to a depth specified by the supervising geologist/engineer.

Specifically a minimum of nominal 12 inch diameter borehole will be advanced up to five feet into the confining layer. Water from a controlled source may be introduced into the borehole for the purpose of removing drill cuttings and to cool the drilling tools. An 8 inch casing will be grouted into the borehole. The bentonite/cement grout will be tremed or pressure grouted and allowed to set prior to drilling through the confining layer. The remaining borehole will be nominal 8 in diameter to the depth specified by the supervising hydrogeologist.

Samples of the encountered subsurface materials shall be collected at a minimum of every five (5) feet and/or change in material or at the discretion of the supervising geologist. The sampling method employed shall be ASTM D-1586-67/Split Barrel Sampling using either a standard 2' long, 2" outside diameter split spoon sampler with a 140 lb. hammer or a 3" outside diameter sampler with a 300 lb. hammer. Upon retrieval of the sampling barrel, the collected sample shall be placed in glass jars and labelled, stored on site (on ice in a cooler if necessary), and transmitted to the appropriate testing laboratory or storage facility.

A geologist will be on site during the drilling operations to fully describe each soil sample including 1) Soil type, 2) color, 3) percent recovery, 4) moisture content, 5) odor and 6) miscellaneous observations such as organic content. The supervising geologist will be responsible for retaining a representative portion of each sample in a one pint glass jar labelled with 1) site, 2) boring number 3) interval sample/interval preserved, 4) date, and 5) time of sample collection.

The drilling contractor will be responsible for obtaining accurate and representative samples, informing the supervising geologist of changes in drilling pressure, keeping a separate general log of soils encountered including blow counts (i.e. the number of blows from a soil sampling drive weight (140 pounds) required to drive the split spoon sampler in 6-inch increments and installing monitoring wells to levels directed by the supervising geologist following specifications further outlined in this protocol.

### II. Monitoring Well Completion

All monitoring wells will be constructed of twenty (20) feet of .020 inch slot, Schedule 40, 4 inch ID PVC, well screen and flush jointed, threaded riser casing that will extend from the screened interval to approximately two feet above existing grade. Other materials utilized for completion will be washed silica sand bentonite, Portland Cement and a protective steel locking cap with locks.

The monitoring well installation method for wells installed within unconsolidated sediments shall be to place the screen and riser assembly into the casing once the screen interval has been selected. At that time a washed silica sand pack will be placed around the well screen if required to prevent screen plugging. If a sand pack is not warranted, the auger string will be pulled back to allow the native aquifer material to collapse 2-5' above the top of the screen. A minimum of 2 feet of Bentonite will then be added to the annulus between the monitoring well casing and the inside casing wall. Cement/Bentonite grout will be added via tremie pipe during the extraction of the drill casing until the entire confining layer and aquifer thickness has been sufficiently sealed off from horizontal and/or vertical flow above the screened interval. During placement of sand, bentonite, and grout frequent measurements will be made by a weighted drop tape measure.

A vented protective steel shall be located over the PVC standpipe extending two (2) feet below grade and 2-3' above grade secured by a Portland Cement seal. The cement seal shall extend laterally at least one foot (1') in all directions from the protective casing and shall slope gently away to drain water away from the well. A vented steel cap will be fitted on the protective casing. This cap shall be constructed so it can be secured with a padlock.

A typical double cased monitoring well detail is attached. The supervising geologist shall specify the monitoring well design to the Drilling Contractor before installation.

## WELL DEVELOPMENT PROTOCOL

All monitoring wells will be developed or cleared of fine grained materials and sediments that have settled in or around the well during installation to insure the screen is transmitting representative portions of the ground water. The development will be by one of three methods, air surging, pumping or bailing ground water from the well until it yields, sediment free water.

Air surging will consist of a clean polypropylene tubing extended to the screened portion of the well, attached to an air compressor and allowed to surge until the ground water clears. The air compressor will include a filter to prevent oil from contaminating the well. Clean polypropylene tubing will be used for each well developed by this method. If air surging is used sampling may not occur within two weeks of air surging.

In pumping or bailing a decontaminated pump or bailer will be used followed procedures outlined in the Decontamination protocol and subsequently decontaminated after each use. Ground water will be pumped from the bottom of the well using a Keck model stainless steel submersible pump or equivalent or bailed using a stainless steel bailer. Clean plastic will be placed on the ground to avoid surface contamination and new polypropylene rope on the bailer will be used for each well. Pumping or bailing will continue for a minimum of one hour and a maximum of four hours.

## DECONTAMINATION PROTOCOL

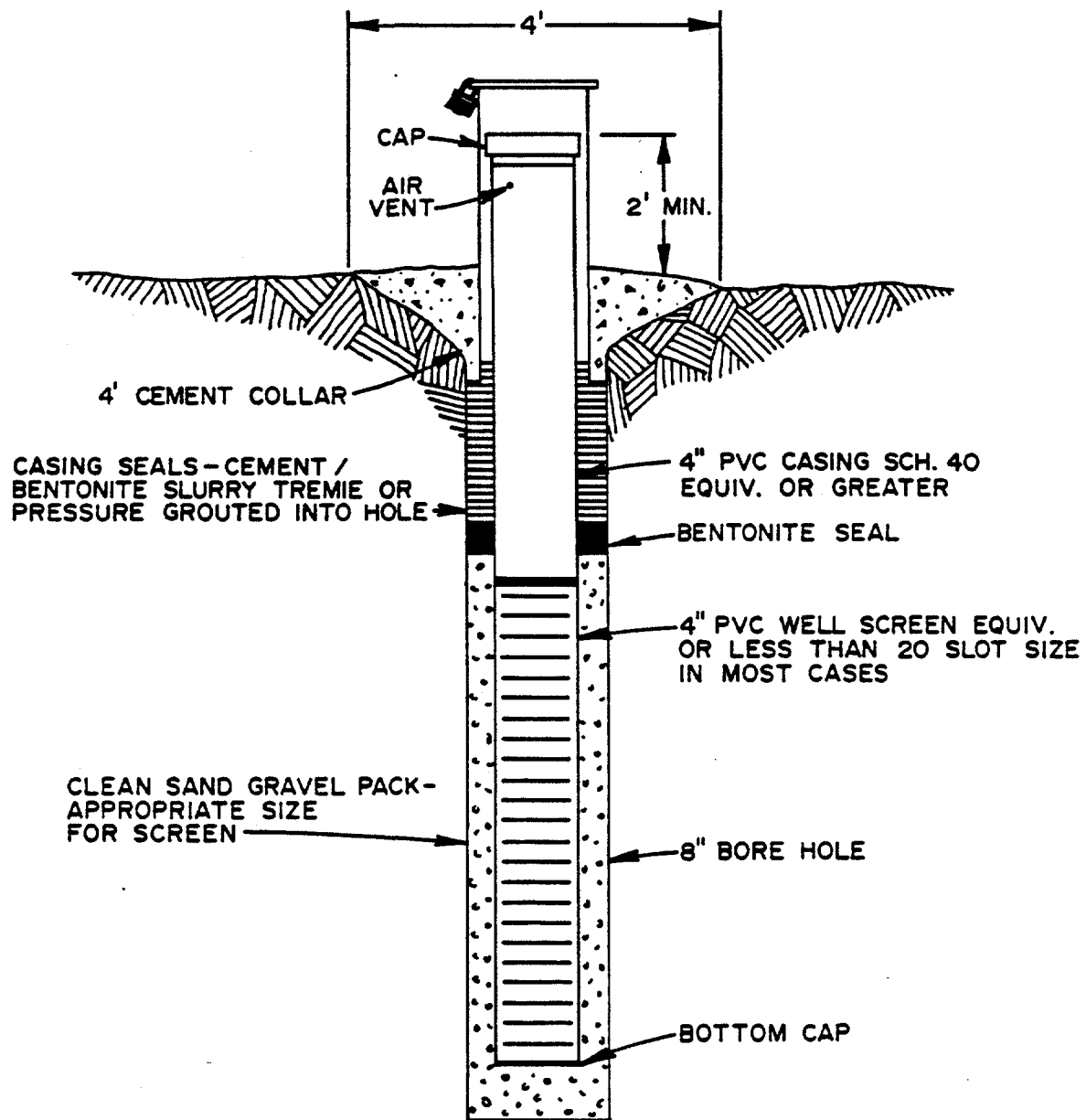
All drilling equipment and associated tools include augers, drill bits, drill rods, sampling equipment, wrenches and any other equipment or tools that have come in contact with contaminated materials shall be decontaminated. The decontamination procedure shall be to use a high pressure wash to remove soils from the equipment. The water used for this procedure shall come from a controlled source.

The frequency of the decontamination will be determined by the supervising hydrogeologist. At a minimum, the decontamination will be performed prior to the initiation of the drilling program between well nests and prior to removing the equipment from the site.

Sampling equipment will be decontaminated in accordance with Appendix B.

Non sampling equipment used in Zones I, II, or III will be decontaminated as follows:

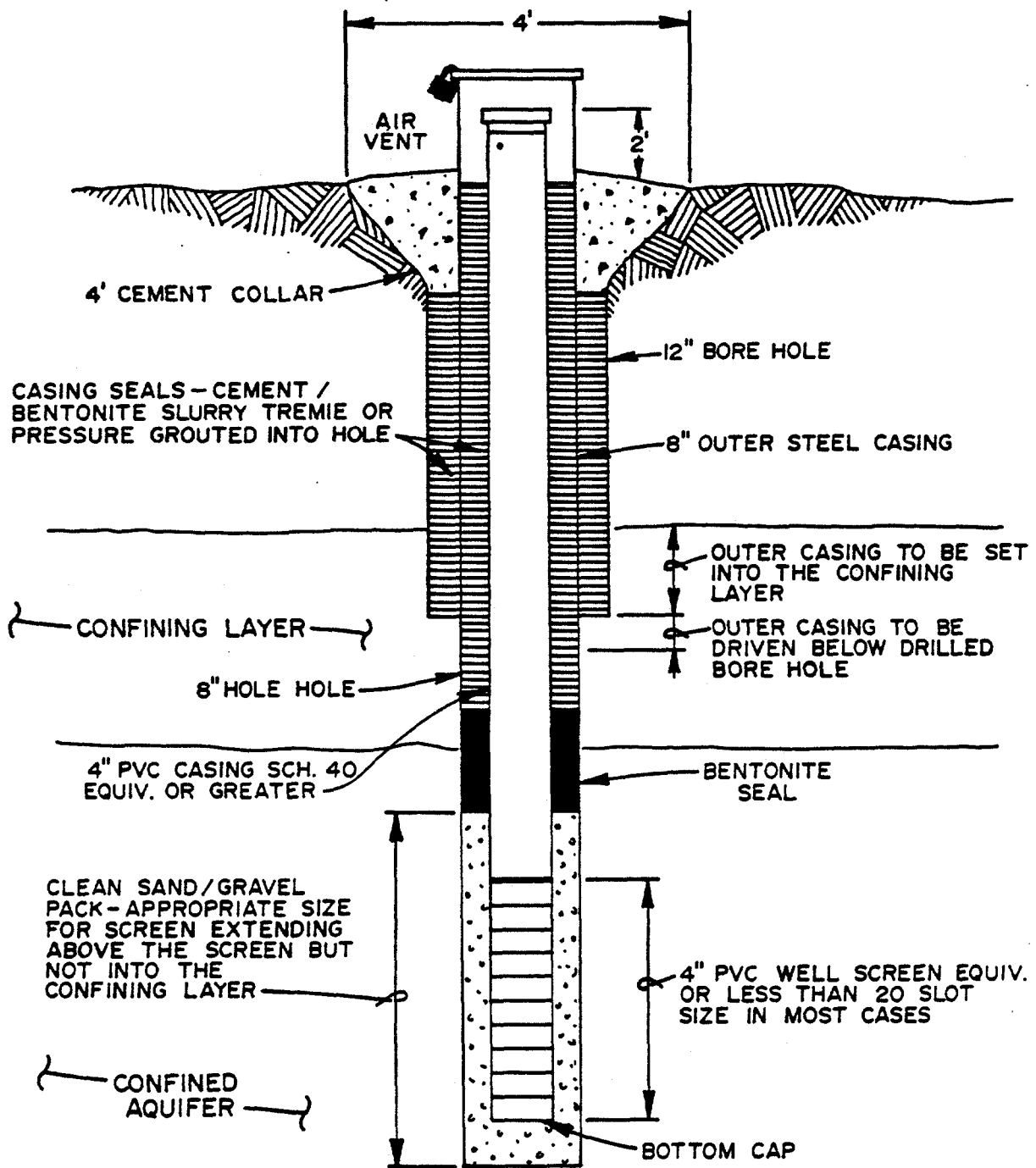
1. Tap water rinse
2. Soap as needed
3. Scrub with brush to remove caked-on soils
4. Triple tap water rinse
5. Contain liquids in existing truck wash pad sump
6. Dispose of liquids with leachate from landfill



## TYPICAL OVERBURDEN MONITORING WELL

N. T. S.





## TYPICAL MONITOR WELL FOR CONFINED UNCONSOLIDATED AQUIFERS

N. T. S.

APPENDIX N  
GAMMA RAY LOGGING PROTOCOL

## GAMMA RAY LOGGING PROTOCOL

Monitor wells specified by the supervising geologist will be gamma ray logged using Johnson-Keck GR-81 Gamma Ray Logging System or equivalent in accordance with the operating instructions by O'Brien & Gere Engineers. Copies of the operating instructions will be maintained with the equipment.

Initially, the time constant and range will be set based on the gamma radiation variations for the borehole and recorded on the data sheet together with the date, well or boring number, water level, and type of drilling fluid. A background reading (counts per unit time) shall be recorded by holding the probe in the open air in the vicinity of the well to be tested. Then the probe will be lowered to the bottom of the well or borehole and the depth and counts per unit time will be recorded on the data sheet (Attachment A). The probe will be raised in increments predetermined by the supervising geologist and the depth and counts per minute will be recorded at each increment until the top of the borehole or well is reached. After the gamma ray logging is completed, an additional background reading shall be recorded.

The data will be plotted on a standard form (Attachment B) adjacent to the stratigraphic column for that borehole.

The probe and cable shall be decontaminated using a control water rinse followed by a dilute solution of Nanograde acetone swabbing and distilled water rinse upon completion of gamma ray logging of each borehole or well.

# GAMMA RAY LOG

LOCATION \_\_\_\_\_ TIME CONSTANT \_\_\_\_\_ TYPE OF FLUID \_\_\_\_\_  
 LOGGED BY \_\_\_\_\_ RANGE \_\_\_\_\_ BORE HOLE TYPE \_\_\_\_\_  
 DATE/TIME \_\_\_\_\_ DEPTH TO FLUID \_\_\_\_\_ PROBE TYPE \_\_\_\_\_

DESCRIPTION

STRATIGRAPHIC  
COLUMN

RANGE (COUNTS PER MINUTE)

DEPTH

APPENDIX O  
CORRECTION TO TABLE 7 OF RI/FS WORK PLAN

Table 7  
NSNJ Pedricktown  
Observation Wells  
Ground Water Quality Data

Parameter	Units	Well HS		Well HD		Well JS		Well ID		Well JS		Well JD		Well KS		Well KD		Well LS		Well LD		Well MS		Well MD	
		Water Table		Water Table		Water Table		Water Table		Water Table		Water Table		Water Table		Water Table		Water Table		Water Table		Water Table		Water Table	
		n	Max	n	Max	n	Max	n	Max	n	Max	n	Max	n	Max	n	Max	n	Max	n	Max	n	Max	n	Max
Antimony Sb	ug/l	-	-	1	0.05	1	0.05	1	0.05	-	-	-	-	1	0.05	-	-	-	-	-	-	-	-	-	-
Arsenic As	ug/l	-	-	1	0.024	1	0.041	1	0.232	-	-	-	-	1	0.046	-	-	-	-	-	-	-	-	-	-
Arsenic Filter	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium Ba	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium Cd	ug/l	-	-	1	0.06	1	0.02	1	0.02	-	-	-	-	1	0.27	-	-	-	-	-	-	-	-	-	-
Cadmium Filter	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloride Cl	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium (Total)	ug/l	-	-	1	0.16	1	0.05	1	0.29	-	-	-	-	1	0.22	-	-	-	-	-	-	-	-	-	-
Chromium (Hex)	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	ug/l	-	-	1	0.13	1	0.05	1	0.14	-	-	-	-	1	0.43	-	-	-	-	-	-	-	-	-	-
Cyanide	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoride	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron Fe	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead Pb	ug/l	2	2.65	3	0.18	3	1.10	3	0.23	2	10.73	2	0.21	3	0.39	2	0.31	2	0.17	2	0.32	2	0.24	2	3.06
Lead Filter	ug/l	3	2.36	3	0.06	3	0.85	3	0.01	3	9.59	3	0.02	3	0.23	3	0.28	3	0.06	3	0.32	3	0.24	3	3.62
Manganese Mn	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese Filter	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	ug/l	-	-	1	0.001	1	0.001	1	0.001	-	-	-	-	1	0.001	-	-	-	-	-	-	-	-	-	-
Nitrate	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium Se	ug/l	-	-	1	0.104	1	0.081	1	0.14	-	-	-	-	1	0.157	-	-	-	-	-	-	-	-	-	-
Selenium Filter	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silver	ug/l	-	-	1	0.01	1	0.01	1	0.052	-	-	-	-	1	0.03	-	-	-	-	-	-	-	-	-	-
Sodium	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulfate SO4	ug/l	3	7500	3	2580	3	1250	3	483	3	4490	3	1360	2	3520	3	1480	3	76	3	11100	3	8550	3	212
Sulfite	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tin Sn	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	ug/l	-	-	1	0.01	1	0.20	1	0.33	-	-	-	-	1	1.4	-	-	-	-	-	-	-	-	-	-
T.O.C.	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Surfactants	ug/l LAS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B.O.D.	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C.O.D.	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Color	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hardness	ug/l (as CaCO3)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Odor	TON	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pH	S.U.	3	4.6(2.6)	3	5.8(4.2)	3	6.0(4.5)	3	6.3(4.0)	3	5.0(3.4)	3	6.1(3.5)	3	5.1(3.3)	3	6.0(4.4)	3	5.0(3.3)	3	4.4(2.6)	3	4.2(2.4)	3	7.3(4.0)
Phenols	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T.D.S.	ug/l	2	8250	2	3500	2	1753	2	855	2	5600	2	2360	2	5320	2	2180	2	272	2	15800	2	11300	2	373
Turbidity	NTU	2	11000	2	5.5	2	62	2	250	2	3.8	2	4.5	2	45	2	30	2	73	2	11000	2	16	2	70
Fecal Coliform	Col/100 ml	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Coliform	Col/100 ml	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oil & Grease	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NIS -H	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Conductivity	microohms	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOH	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Endrin	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lindane	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methoxychlor	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Toxaphene	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4 D	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4,5-TP	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 7  
(continued)  
NSNJ Pedricktown  
Observation Wells  
RADIOANALYTICAL DATA

Parameter	Units	Well HS		Well HD		Well IS		Well ID		Well JS		Well JD		Well KS		Well KD		Well LS		Well LD		Well MS		Well MD	
		Water Table		Water Table		Water Table		Water Table		Water Table		Water Table		Water Table		Water Table		Water Table		Water Table		Water Table		Water Table	
		n	Max	n	Max	n	Max	n	Max	n	Max	n	Max	n	Max	n	Max	n	Max	n	Max	n	Max	n	Max
Gross Alpha	pCi/l	-	-	-	-	-	-	-	-	1	193 40	-	133 28	-	-	-	-	-	-	-	-	1	15.8 3.12	1	51 16
Gross Beta	pCi/l	-	-	-	-	-	-	-	-	1	166 25	1	96 16	-	-	-	-	-	-	-	-	1	19.6 2.19	1	55 10
Radium (total)	pCi/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Radium 226	pCi/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Ce-144	pCi/l	-	-	-	-	-	-	-	-	1	39.0	1	22.5	-	-	-	-	-	-	-	-	1	(= 40.6	1	31.3
Ce-141	pCi/l	-	-	-	-	-	-	-	-	1	30.1	1	5.48	-	-	-	-	-	-	-	-	1	(= 35.8	1	26.3
Ru-103	pCi/l	-	-	-	-	-	-	-	-	1	16.5	1	10.6	-	-	-	-	-	-	-	-	1	(= 13.7	1	10.4
Cs-134	pCi/l	-	-	-	-	-	-	-	-	1	4.75	1	3.57	-	-	-	-	-	-	-	-	1	(= 3.19	1	2.90
Ra-226 Bi	pCi/l	-	-	-	-	-	-	-	-	1	16 9	1	8.41	-	-	-	-	-	-	-	-	1	(= 9.08	1	8.08
Ru-106	pCi/l	-	-	-	-	-	-	-	-	1	47.8	1	35.2	-	-	-	-	-	-	-	-	1	(= 40.6	1	30.2
Cs-137	pCi/l	-	-	-	-	-	-	-	-	1	5.10	1	3.91	-	-	-	-	-	-	-	-	1	(= 4.08	1	3.18
Zr-95	pCi/l	-	-	-	-	-	-	-	-	1	16.4	1	12.1	-	-	-	-	-	-	-	-	1	(= 15.0	1	11.1
Nb-95	pCi/l	-	-	-	-	-	-	-	-	1	9.30	1	7.00	-	-	-	-	-	-	-	-	1	(= 10.5	1	7.73
Co-58	pCi/l	-	-	-	-	-	-	-	-	1	8.71	1	6.12	-	-	-	-	-	-	-	-	1	(= 8.72	1	6.63
Mn-54	pCi/l	-	-	-	-	-	-	-	-	1	5.30	1	3.83	-	-	-	-	-	-	-	-	1	(= 5.13	1	3.97
Fe-57	pCi/l	-	-	-	-	-	-	-	-	1	25.4	1	17.1	-	-	-	-	-	-	-	-	1	(= 27.7	1	20.1
Iy-65	pCi/l	-	-	-	-	-	-	-	-	1	12.0	1	8.17	-	-	-	-	-	-	-	-	1	(= 12.2	1	9.14
Co-60	pCi/l	-	-	-	-	-	-	-	-	1	5.02	1	4.05	-	-	-	-	-	-	-	-	1	(= 5.09	1	3.79
K-40	pCi/l	-	-	-	-	-	-	-	-	1	50.9	1	43.8	-	-	-	-	-	-	-	-	1	(= 48.1	1	40.3
Cr-51	pCi/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(= 209	-	-	
I-131	pCi/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Ba-140 La	pCi/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(= 233	-	-	

Table 7  
NSNJ Pedricktown  
Observation Wells  
Ground Water Quality Data

Parameter	Units	Well NS		Well ND		Well OS		Well OD		Well PS		Well PD		Well OS		Well OD		Well RS		Well RD		Well SS		Well SD	
		Water Table		Water Table		Water Table		Water Table		Water Table		Water Table		Water Table		Water Table		Water Table		Water Table		Water Table		Water Table	
		n	Max	n	Max	n	Max	n	Max	n	Max	n	Max	n	Max	n	Max	n	Max	n	Max	n	Max	n	Max
Antimony Sb	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.05	-	-	-	-	-	-
Arsenic As	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.031	-	-	-	-	-	-
Arsenic Filter	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium Ba	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium Cd	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.01	-	-	-	-	-	-
Cadmium Filter	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloride Cl	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium (Total)	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.4	1	0.29	-	-	-	-	-	-
Chromium (Hex)	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.1	1	0.28	-	-	-	-	-	-
Cyanide	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoride	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron Fe	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead Pb	ug/l	2	1.18	2	0.12	2	0.63	2	0.66	2	0.02	2	0.27	1	0.08	2	0.20	2	2.7	2	0.32	2	2.01	2	2.96
Lead Filter	ug/l	3	0.51	3	0.01	3	0.43	3	0.54	3	0.02	3	0.14	2	0.08	2	0.14	2	0.01	2	0.05	3	1.70	3	2.52
Manganese Mn	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese Filter	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.015	1	0.001	-	-	-	-	-	-
Nitrate	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium Se	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.044	-	-	-	-	-	-
Selenium Filter	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.04	-	-	-	-	-	-
Silver	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.04	-	-	-	-	-	-
Sodium	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulfate SO4	ug/l	3	480	3	3900	3	5300	3	9000	3	536	3	1300	2	2600	2	14500	2	70	2	63	3	8380	3	35500
Sulfite	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tin Sn	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2.0	1	0.91	-	-	-	-	-	-
T.O.C.	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Surfactants	ug/l LRS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B.O.D.	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C.O.D.	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Color	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hardness	mg/l (as CaCO3)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Odor	TON	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pH	S.U.	3	6.0(4.0)	3	5.5(3.7)	3	5.6(3.5)	3	5.5(3.5)	3	7.0(4.0)	3	7.1(4.5)	2	6.6(4.0)	2	5.6(4.6)	2	7.2(5.0)	2	7.2(5.0)	3	6.8(2.6)	3	4.2(2.2)
Merols	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T.O.S.	ug/l	2	550	2	3090	3	7490	2	10500	2	910	2	1880	2	2400	2	20700	2	202	2	215	2	8580	2	35100
Turbidity	NTU	2	757	2	33	2	95	2	20	2	6.8	2	5.0	2	62	2	150	2	22	2	11000	2	150	2	125
Fecal Coliform	Col/100 ml	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Coliform	Col/100 ml	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oil & Grease	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PH3 H	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Conductivity	micromohs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
THH	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Endrin	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lindane	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heptachlor	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Toxaphene	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4-D	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,4,5-TP	ug/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Table 7  
(continued)  
NSNJ Pedricktown  
Observation Wells  
RADIOANALYTICAL DATA

Parameter	Units	Well NS		Well ND		Well OS		Well OD		Well PS		Well PD		Well QS		Well QD		Well RS		Well RD		Well SS		Well SD	
		Water Table		Water Table		Water Table		Water Table		Water Table		Water Table		Water Table		Water Table		Water Table		Water Table		Water Table		Water Table	
		n	Max	n	Max	n	Max	n	Max	n	Max	n	Max	n	Max	n	Max	n	Max	n	Max	n	Max	n	Max
Gross Alpha	pCi/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	604.90	1	76.16	-	-	-	-
Gross Beta	pCi/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	350.34	1	69.12	-	-	-	-
Plutonium (total)	pCi/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Radium 226	pCi/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ce-144	pCi/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	20.5	-	-	-	-
Ce-141	pCi/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	16.3	-	-	-	-
Ru-103	pCi/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	9.70	-	-	-	-
Cs-134	pCi/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2.89	-	-	-	-
Ra-226 Bi	pCi/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	15.11	1	6.53	-	-	-	-
Ru-106	pCi/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	31.1	-	-	-	-
Cs-137	pCi/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	3.28	-	-	-	-
Zr-95	pCi/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	10.7	-	-	-	-
Nb-95	pCi/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2.72	-	-	-	-
Co-58	pCi/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	5.33	-	-	-	-
Mn-54	pCi/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	3.30	-	-	-	-
Fe-59	pCi/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	15.0	-	-	-	-
Zn-65	pCi/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	7.01	-	-	-	-
Ce-60	pCi/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	3.00	-	-	-	-
N-40	pCi/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	30.7	-	-	-	-
Cr-51	pCi/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
I-131	pCi/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ra-140 La	pCi/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

**APPENDIX P**  
**BULK AND CONTAINERIZED MATERIALS INVENTORY PROTOCOL**

## BULK AND CONTAINERIZED MATERIALS INVENTORY PROTOCOL

The bulk and containerized materials inventory will identify the approximate location, volume, and type of materials present at the NSNJ Pedricktown site. The bulk materials consist primarily of slag and equipment residue, whereas the containerized materials include baghouse dust, miscellaneous process wastes, and raw materials. Bulk materials are defined as materials which are piled, stored, or otherwise present at the site in an uncontained state. The containerized materials are materials resident in drums, barrels, kettles, pots, tanks, or other types of containers which may or may not be open to the environment. The inventory will be based on a visual inspection of the site.

The bulk materials will be inventoried using the following procedures:

1. Identify the approximate location of bulk material, taking measurements from landmarks as necessary. Record in log book using Table P-1, and/or on-site map.
2. Identify the approximate horizontal and vertical extent of the bulk material. Record information in log book using Table P-1 and/or on-site map.
3. Record in log book the general appearance of the bulk material and the type of material, if known.
4. Record in log book and/or site map, a discrete number, in accordance with the sample numbering system, to identify each bulk material during future RI/FS activities.

The containerized materials will be monitored using the following procedures:

1. Identify the approximate location of containerized material, taking measurements from landmarks as necessary. Record information in log book using Table P-2 and/or on-site map.
2. Identify the approximate container volume, % full liquid, and % full solid. Record information in log book using Table P-2.
3. Record in log book the general appearance of the container and containerized material, and the type of material, if known.
4. Label each container with a discrete number in accordance with the sample numbering system, to identify each container during future RI/FS activities. Record container number in log book.

TABLE P-1. BULK MATERIAL INVENTORY FORM

<u>I.D. No.</u>	<u>Horizontal Dimension</u>	<u>Vertical Dimension</u>	<u>Volume</u>	<u>Description</u>
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TABLE P-2. CONTAINERIZED MATERIAL INVENTORY FORM

<u>I.D. No.</u>	<u>% Full Liquid</u>	<u>% Full Solid</u>	<u>Container Volume</u>	<u>Description</u>
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# Exhibits

NLI 001 0764



**O'BRIEN & GERE**

**EXHIBIT A**



**LEGGETTE, BRASHEARS, & GRAHAM, INC.**  
**CONSULTING GROUND-WATER GEOLOGISTS**

**EDWARD T. SIMMONS**  
**G. SIDNEY FOX**  
**FRANK H. CRUM**  
**R. G. SLAYBACK**  
**S. I. STRAUSSBERG**

**WILTON**  
**72 DANBURY ROAD**  
**WILTON, CT. 06897**  
**(203) 762-1207**  
**CABLE ADDRESS - LEBRAGRA**

**TAMPA**  
**1211 N. WESTSHORE BLVD.**  
**TAMPA, FL. 33607**  
**(813) 879-8177**  
**CABLE ADDRESS - AQUAFLA**

**WATER SUPPLY**  
**DEWATERING**  
**RECHARGING**  
**SALT WATER PROBLEMS**  
**POLLUTION STUDIES**  
**REPORTS**

**PLEASE ADDRESS REPLY TO**  
**WILTON, CONNECTICUT**

**July 30, 1980**

**Mr. Carl Libsch**  
**Plant Manager**  
**NL Industries**  
**Penns Grove - Auburn Road**  
**Pedricktown, NJ 08067**

**SUBJECT: Adequacy and Validity of Monitoring**  
**Facilities and Data Collected in Compliance**  
**With The New Jersey Division of Water**  
**Resources Requirements For Ground-Water**  
**Quality Monitoring at NL's Pedricktown Plant**

**Dear Mr. Libsch:**

In accordance with my July 11, 1980 letter to you, I am herein reporting on the adequacy and validity of ground-water monitoring facilities and data in compliance with requirements of the New Jersey Division of Water Resources (DRW). The purpose of monitoring facilities and data collection was to evaluate the ground-water quality of the underlying aquifer systems as related to Pedricktown plant operations.

**Ground-Water Monitoring Facilities**

From the start of the program, October 1975, to the present, a total of 21 wells have been completed at 11 sites at the plant. Of the 21 wells 10 are replacements for wells that have either been silted up or have had to be relocated because of new landfill construction. Six (A, B, C, 6, 8, and 9) of the 11 sites concern the DWR and details covering well drilling, logging, construction, development, performance and abandonment (where applicable) of replacement and/or

original wells at the 6 sites have been reported to you in the Leggette, Brashears & Graham, Inc. (LBG) report of May 30, 1980. It is the opinion of LBG that the 6 wells presently being utilized for ground-water monitoring purposes at the 6 sites concerning DWR are adequately designed and constructed and that abandoned wells are adequately sealed. Well logs, construction details, screen settings, water levels and specific capacities were included in our May 30, 1980 report.

#### Validity of Water Samples Taken for Chemical Analysis

Prior to the spring of 1980, water samples of varying and largely unknown turbidity, were collected by pumping with submersible pump in then existing wells at the 6 referenced sites. Because of the very silty and clayey nature of aquifer zones underlying the plant site, -it is very difficult to obtain turbid free water from the 4-inch diameter monitoring wells required by the DWR, even if the wells are properly designed, constructed, gravel packed and intensively developed. One of the major constraints is that the very low yields that can be obtained from shallow 4-inch wells having short screen lengths in one of the thin aquifer zones preclude the degree of development that can be imposed on large diameter water-supply wells having deep and multiple screen settings. Research performed by LBG in late 1979 and early 1980 indicated that unless relatively turbid free ground-water samples are obtained, heavy metal analytical results could be totally misleading. This is due to the affinity of silt and clay particles to retain relatively large amounts of heavy metals compared to the amounts that can be dissolved in ground water. Because ground water flowing through the aquifers cannot carry particulate matter under natural ground-water gradients, water samples containing little or no turbidity are essential for proper evaluation of heavy metal concentrations in the ground water at specific well

sites. When any well is pumped, the gradients in the immediate vicinity of the well screen are enormously increased due to the development of the cone of depression caused by lowering the water level in the well casing. This leads to a very large increase of ground-water velocity immediately outside the well screen which tends to cause migration of silt and clay particles from the aquifer into the well where they are included in water samples. Theoretically, proper gravel packing should sieve out the fine-grained materials but because of the very wide range of particle sizes, this may not be possible, especially immediately after commencement of pumping. However, after some period of constant pumpage at a low rate, it has been shown that the turbidity generally decreases to a more or less acceptable level.

After the turbidity/heavy metals phenomena was established by LBG, monitoring wells were redeveloped and/or replaced and pumping rates and schedules were carefully set to minimize or eliminate turbidity in ground-water samples. Additionally, contrary to prior analytical procedures, all ground-water samples were analyzed for turbidity. This essential requirement was not established by DWR when monitoring guidelines were originally imposed on NL.

In summary then, we feel that only the analytical results of samples collected within the last few months show sufficiently low turbidity to warrant confidence.

#### Ground-Water Sampling Procedure

I feel that the present sampling procedure is adequate. The procedure was established by LBG in April 1980 and has been transmitted to NL. The present methodology follows:

Lower submersible pump slowly and gently to depth indicated in table 1 to remove "dead" column of water in upper part of casing. Pump three times the amount of water originally in casing (table 1) at low constant rate (1 to 2 gpm) before collecting water sample. If sample appears turbid continue pumping until water is clear before

Mr. Carl Libsch

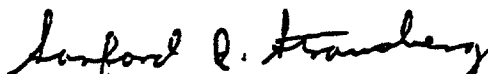
-4-

July 30, 1980

collecting sample for analysis. Measure turbidity of  
sample immediately after collection.

Respectfully submitted,

LEGGETTE, BRASHEARS & GRAHAM, INC.

  
Sanford I. Strausberg  
Vice President

SIS:ag

Table 1

NL INDUSTRIES  
PEDRICKTOWN PLANT  
PEDRICKTOWN, NEW JERSEY

Depth of Pump Settings and Minimum Volumes of Water  
to be Removed before Collecting Turbid Free Water  
for Chemical Analyses, NL Plant, Pedricktown, New Jersey

Well	Depth of pump setting in feet below top of casing	Minimum volume to be removed before collecting sample for chemical analysis, in gallons
AR	16	60
BR	7	72
CR2	17	45
6	10	36
8R	35	180
9R2	28	90

EXHIBIT B



# REGULATORY GUIDE

## OFFICE OF STANDARDS DEVELOPMENT

### REGULATORY GUIDE 4.15

## QUALITY ASSURANCE FOR RADIOLOGICAL MONITORING PROGRAMS (NORMAL OPERATIONS) — EFFLUENT STREAMS AND THE ENVIRONMENT

### A. INTRODUCTION

This guide describes a method acceptable to the NRC staff for designing a program to assure the quality of the results of measurements of radioactive materials in the effluents and the environment outside of nuclear facilities during normal operations.

\* The NRC regulations that require the control of releases of radioactive materials from nuclear facilities, that require the measurements of radioactive materials in the effluents and environment outside of these facilities, that require quality assurance programs and establish quality assurance requirements for certain facilities, or that authorize license conditions not otherwise authorized in the regulations are as follows:

Section 20.106, "Radioactivity in Effluents to Unrestricted Areas," of 10 CFR Part 20, "Standards for Protection Against Radiation," provides that a licensee shall not release to an unrestricted area radioactive materials in concentrations that exceed limits specified in 10 CFR Part 20 or as otherwise authorized in a license issued by the Commission. Section 20.201, "Surveys," of 10 CFR Part 20 further requires that a licensee conduct surveys, including measurements of levels of radiation or concentrations of radioactive materials, as necessary to demonstrate compliance with the regulations in 10 CFR Part 20.

Paragraph (c) of Section 20.1, "Purpose," of 10 CFR Part 20 states that every reasonable effort should be made by NRC licensees to maintain radiation exposure, and releases of radioactive materials in effluents to unrestricted areas, as far below the limits specified in

Part 20 as is reasonably achievable, taking into account the state of technology and the economics of improvements in relation to public health and safety and to the utilization of atomic energy in the public interest.

Section 30.34, "Terms and Conditions of Licenses," of 10 CFR Part 30, "Rules of General Applicability to Licensing of Byproduct Material," provides that the Commission may incorporate in any byproduct material license such terms and conditions as it deems appropriate or necessary in order to protect health.

Section 40.41, "Terms and Conditions of Licenses," of 10 CFR Part 40, "Licensing of Source Material," provides that the Commission may incorporate in any source material license such terms and conditions as it deems appropriate or necessary to protect health.

Section 50.50, "Issuance of Licenses and Construction Permits," of 10 CFR Part 50, "Licensing of Production and Utilization Facilities," provides that each operating license for a nuclear power plant issued by the Nuclear Regulatory Commission will contain such conditions and limitations as the Commission deems appropriate and necessary.

Section 70.32, "Conditions of Licenses," of 10 CFR Part 70, "Special Nuclear Material," provides that the Commission may incorporate such terms and conditions as it deems appropriate or necessary to protect health.

Section IV.B of Appendix I, "Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion 'As Low As Is Reasonably Achievable' for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents," to 10 CFR Part 50, "Licensing of Production and Utilization Facilities," requires that licensees establish an ap-

\* Lines indicate substantive changes from previous issue.

### USNRC REGULATORY GUIDES

Regulatory Guides are issued to describe and make available to the public methods acceptable to the NRC staff of implementing specific parts of the Commission's regulations, to describe techniques used by the staff in evaluating specific problems or postulated accidents, or to provide guidance to applicants. Regulatory Guides are not substitutes for regulations, and compliance with them is not required. Methods and procedures different from those set out in the guides will be acceptable if they provide a basis for the findings required to the issuance or continuance of a permit or license by the Commission.

Comments and suggestions for improvements in these guides are encouraged at all times, and guides will be revised, as appropriate, in accordance with comments and to reflect new information or experience. This guide was revised as a result of substantive comments received from the public and administrative staff review.

Comments should be sent to the Secretary of the Commission, U.S. Nuclear Regulatory Commission, Washington, D.C. 20546, Attention: Duckeung and Service Branch.

The guides are issued in the following ten broad divisions:

- |                                   |                                   |
|-----------------------------------|-----------------------------------|
| 1. Power Reactors                 | 6. Products                       |
| 2. Research and Test Reactors     | 7. Transportation                 |
| 3. Fuel and Materials Facilities  | 8. Occupational Health            |
| 4. Environmental and Siting       | 9. Antitrust and Financial Review |
| 5. Materials and Plant Protection | 10. General                       |

Requests for single copies of issued guides (which may be reproduced) or for placement on an automatic distribution list for single copies of future guides in specific divisions should be made in writing to the U.S. Nuclear Regulatory Commission, Washington, D.C. 20546, Attention: Director, Division of Technical Information and Document Control.

appropriate surveillance and monitoring program to provide data on quantities of radioactive material released in liquid and gaseous effluents and to provide data on measurable levels of radiation and radioactive materials in the environment. Section III.B of Appendix I to 10 CFR Part 50 provides certain effluent and environmental monitoring requirements with respect to radioactive iodine if estimates of exposure are made on the basis of existing conditions and if potential changes in land and water usage and food pathways could result in exposures in excess of the guidelines of Appendix I to 10 CFR Part 50.

General Design Criterion 60, "Control of releases of radioactive materials to the environment," of Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50 requires that nuclear power plant designs provide means to control suitably the release of radioactive materials in gaseous and liquid effluents. General Design Criterion 64, "Monitoring radioactivity releases," of Appendix A to 10 CFR Part 50 requires that nuclear power plant designs provide means for monitoring effluent discharge paths and the plant environs for radioactivity that may be released from normal operations, including anticipated operational occurrences, and from postulated accidents.

General Design Criterion 1, "Quality standards and records," of Appendix A to 10 CFR Part 50 requires that a quality assurance program be established for those structures, systems, and components of a nuclear power plant that are important to safety in order to provide adequate assurance that they will satisfactorily perform their safety functions.

Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50 establishes quality assurance requirements for the design, construction, and operation of those structures, systems, and components of these facilities that prevent or mitigate the consequences of postulated accidents that could cause undue risk to the health and safety of the public.

The need of quality assurance is implicit in all requirements for effluent and environmental monitoring, and this need has been widely recognized. Regulatory Guide 1.21, "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants;" Regulatory Guide 4.1, "Programs for Monitoring Radioactivity in the Environs of Nuclear Power Plants;" Regulatory Guide 4.8, "Environmental Technical Specifications for Nuclear Power Plants;" and Regulatory Guide 4.14, "Measuring, Evaluating, and Reporting Radioactivity in Releases of Radioactive Material in Liquid and Airborne Effluents From Uranium

Mills," all give some guidance on means for assuring the quality of the measurements of radioactive materials in effluents and the environment outside of nuclear facilities. More complete and extensive guidance on this subject is provided in this document for nuclear power reactor facilities and for other facilities for which radiological monitoring is required by the NRC. This guidance does not identify separately the activities that are within the scope of Appendix B to 10 CFR Part 50. However, this guidance is intended to be consistent with the requirements of Appendixes A and B to 10 CFR Part 50 in that quality assurance requirements should be consistent with the importance of the activity. For the monitoring of production and utilization facilities that is within the scope of Appendix B to 10 CFR Part 50, other regulatory guides that provide guidance on meeting the quality assurance requirements of Appendix B to 10 CFR Part 50 should also be consulted.

## B. DISCUSSION<sup>1</sup>

As used in the context of this guide, quality assurance comprises all those planned and systematic actions that are necessary to provide adequate confidence in the results of a monitoring program, and quality control comprises those quality assurance actions that provide a means to control and measure the characteristics of measurement equipment and processes to established requirements; therefore, quality assurance includes quality control.

To assure that radiological monitoring measurements are reasonably valid, organizations performing these measurements have found it necessary to establish quality assurance programs. These programs are needed for the following reasons: (1) to identify deficiencies in the sampling and measurement processes to those responsible for these operations so that corrective action can be taken, and (2) to obtain some measure of confidence in the results of the monitoring programs in order to assure the regulatory agencies and the public that the results are valid.

Existing published guidance on specific quality assurance actions that are applicable to radiological monitoring is limited and, in general, is restricted to quality control practices for radioanalytical laboratories (Refs. 1-5). However, quality assurance should be applied to all steps of the monitoring process, which may include sampling, shipment of samples, receipt of samples in the laboratory, preparation of samples, measurement of radioactivity, data reduction, data evaluation, and reporting of the monitoring results.

<sup>1</sup>Definitions of special terms used in this guide are given in the glossary on page 4.15-10.



The scope of this guide is limited to the elements of a quality assurance program, which is a planned, systematic, and documented program that includes quality control. Guidance on principles and good practice in the monitoring process itself and guidance on activities that can affect the quality of the monitoring results (e.g., design of facilities and equipment) are outside the scope of this guide. However, some references are provided to documents that do provide some guidance in these areas. The citation of these references does not constitute an endorsement of all of the guidance in these documents by the NRC staff. Rather, these references are provided as sources of information to aid the licensee and the licensee's contractors in developing and maintaining a monitoring program.

Every organization actually performing effluent and environmental monitoring, whether an NRC licensee or the licensee's contractor, should include the quality assurance program elements presented in this guide.

## C. REGULATORY POSITION

The quality assurance program of each organization performing effluent or environmental monitoring of nuclear facilities for normal operations should be documented by written policies and procedures and records. These documents should include the elements given in this section.

In addition to its own program, a licensee should require any contractor or subcontractor performing monitoring activities for the licensee to provide a quality assurance program and to routinely provide program data summaries (sufficiently detailed to permit ongoing quality assurance program evaluation by the licensee) consistent with the provisions of this guide, as follows:

### 1. Organizational Structure and Responsibilities of Managerial and Operational Personnel

The structure of the organization as it relates to the management and operation of the monitoring program(s), including quality assurance policy and functions, should be presented. The authorities, duties, and responsibilities of the positions within this organization down to the first-line supervisory level should be described. This should include responsibilities for review and approval of written procedures and for the preparation, review, and evaluation of monitoring data and reports.

Persons and organizations performing quality assurance functions should have sufficient authority and organizational freedom to identify quality problems; to initiate, recommend, or provide solutions; and to verify implementation of solutions.

### 2. Specification of Qualifications of Personnel

The qualifications of individuals performing radiological monitoring to carry out their assigned functions should be specified and documented (e.g., as in a job description).

An indoctrination and orientation program, appropriate to the size and complexity of the organization and to the activities performed, should provide that (a) personnel performing quality-related activities are trained and qualified in the principles and techniques of the activities performed, (b) personnel are made aware of the nature and goals of the quality assurance program, and (c) proficiency of personnel who perform activities affecting quality is maintained by retraining, reexamining, and recertifying or by periodic performance reviews, as appropriate.

### 3. Operating Procedures and Instructions

Written procedures should be prepared, reviewed, and approved for activities involved in carrying out the monitoring program, including sample collection; packaging, shipment, and receipt of samples for offsite analysis; preparation and analysis of samples; maintenance, storage, and use of radioactivity reference standards; calibration and checks of radiation and radioactivity measurement systems; and reduction, evaluation, and reporting of data. Individuals who review and approve these procedures should be knowledgeable in the subjects of the procedures.

Guidance on principles and good practice in many of these activities is presented in NRC regulatory guides (Refs. 6-9) and other publications (Refs. 2-5, 10-35). In addition to these publications, Scientific Committee 18A of the NCRP has prepared NCRP Report 58, "A Handbook of Radioactivity Measurements Procedures," (Ref. 36) that is a revision of NCRP Report 28, NBS Handbook 80, "A Manual of Radioactivity Procedures."

### 4. Records

The records necessary to document the activities performed in the monitoring program should be specified in the quality assurance program.

One key aspect of quality control is maintaining the ability to track and control a sample in its progress through the sequence of monitoring processes. Records to accomplish this should cover the following processes: field and inplant collection of samples for subsequent analysis, including sample description; sample receipt and laboratory identification coding; sample preparation and radiochemical processing (e.g., laboratory notebooks); radioactivity measurements of samples, instrument backgrounds, and analytical blanks; and data reduction and verification.

Quality control records for laboratory counting systems should include the results of measurements of radioactive check sources, calibration sources, backgrounds, and blanks.

Records relating to overall laboratory performance should include the results of analysis of quality control samples such as analytical blanks, duplicates, interlaboratory cross-check samples and other quality control analyses; use of standards (radioactivity) to prepare working standards; preparation and standardization of carrier solutions; and calibration of analytical balances.

Additional records that are needed should include the calibration of inline radiation detection equipment, air samplers, and thermoluminescence dosimetry systems; verification and documentation of computer programs; qualifications of personnel; and results of audits.

The minimum period of retention of the records should be specified. For nuclear power plants, requirements for record retention are given in the plant technical specifications. In general, for other types of facilities, only the final results of the monitoring programs need be retained for the life of the facility.

#### 5. Quality Control in Sampling (Including Packaging, Shipping, and Storage of Samples)

Continuous sampling of liquids and gases involves the measurement of sample flow rates and/or sample volumes. The accuracy of the devices used for this purpose should be determined on a regularly scheduled basis, and adjustments should be made as needed to bring the performance of the devices within specified limits. The results of these calibrations should be recorded. The frequency of these calibrations should be specified and should be based on the required accuracy, purpose, degree of usage, stability characteristics, and other conditions affecting the measurement. Procedures for continuous sampling should use methods that are designed to ensure that the sample is representative of the material volumes sampled. The collection efficiencies of the samplers used should be documented; usually such documentation is available from manufacturers of the sampling equipment.

Procedures for grab samples should include steps designed to ensure that the sample is representative of the material sampled. Replicate grab samples should be taken periodically to determine the reproducibility of sampling.

Procedures for sampling, packaging, shipping, and storage of samples should be designed to maintain the integrity of the sample from time of collection to time of analysis. Aqueous samples may present a particular problem in this regard, and one of the most

severe problems has been encountered with aqueous samples of radioactive wastes from operating nuclear reactors (Ref. 23).

Guidance on the principles and practice of sampling in environmental monitoring is provided in several publications (Refs. 2, 4, 5, 21, 23-31, 33, 35, 37). In addition, workers at the National Bureau of Standards (NBS) have published the results of a survey of information on sampling, sample handling, and long-term storage for environmental materials (Ref. 15). Some guidance on the principles and practice of air sampling is provided in References 17, 19, 24, 28-31, 33. Guidance on the principles and practice of water sampling is provided in numerous publications (Refs. 13, 14, 25-27, 35, 37).

#### 6. Quality Control in the Radioanalytical Laboratory

##### 6.1 Radionuclide Reference Standards—Use for Calibration of Radiation Measurements Systems

Reference standards are used to determine counting efficiencies for specific radionuclides or, in the case of gamma-ray spectrometry systems, to determine counting efficiency as a function of gamma-ray energy. A counting efficiency value is used to convert a sample counting rate to the decay rate of a radionuclide or to a radionuclide concentration. Guidance on the calibration and usage of germanium detectors for measurement of gamma-ray emission rates of radionuclides has been prepared as an ANSI standard (Ref. 38). For converting gamma-ray emission rates to nuclear decay rates, two reports from the Oak Ridge National Laboratory (Refs. 39 and 40) provide useful compilations of gamma-ray intensities and other nuclear decay data for radionuclides in routine releases from nuclear fuel cycle facilities. The data from Reference 40 are included in NCRP Report 58 (Ref. 36).

Radionuclide standards that have been certified by NBS or standards that have been obtained from suppliers who participate in measurement assurance activities with NBS<sup>2</sup>

<sup>2</sup>Satisfactory measurement assurance interactions between source suppliers and NBS involve two basic mechanisms: (1) The supplier submits a calibrated radioactivity source (preferably selected from a batch or prepared series of sources) to NBS for confirmation that the supplier's calibration value agrees with NBS results within certain specified limits or (2) NBS provides calibrated radioactivity sources of undisclosed activity (test samples) to a supplier who is able to make activity or emission-rate measurements on the source that agree within certain specified limits with the measurements of NBS. For the routine production of commercial radioactivity standards, the first mechanism is preferable to the second but is not always feasible. These two mechanisms are used both in Measurements Assurance Programs (MAPs) with key laboratories and in other measurement assurance activities.

Two key laboratory source suppliers participate in MAPs with NBS and use both of the two basic mechanisms: (1) The NRC reference laboratory for the Confirmatory Measurements Program (for effluent monitoring) of the NRC Office of Inspection and Enforcement and (2) The EPA Environmental Monitoring and Support Laboratory in Las Vegas, which prepares and

should be used when such standards are available. In these measurement assurance activities, the supplier's calibration value should agree with the NBS value within the overall uncertainty stated by the supplier in its certification of the same batch of sources (when these are sampled for measurement by NBS) or in its certification of similar sources.

An "International Directory of Certified Radioactive Materials" has been published by the International Atomic Energy Agency (Ref. 41).

Acceptable standards for certain natural radionuclides may be prepared from commercially available high-purity chemicals. For example, potassium-40 standards for gross beta-particle measurements or gamma-ray spectrometry may be prepared gravimetrically from dried reagent-grade potassium chloride.

The details of the preparation of working standards from certified standard solutions should be recorded. The working standard should be prepared in the same form as the unknown samples, or close approximation thereto.

Efficiency calibrations should be checked periodically (typically monthly to yearly) with standard sources. In addition, these checks should be made whenever the need is indicated, such as when a significant change in the measurement system is detected by routine measurements with a check source.

## 6.2 Performance Checks of Radiation Measurement Systems

Determination of the background counting rate and the response of each radiation detection system to appropriate check sources should be performed on a scheduled basis for systems in routine use. The results of these measurements should be recorded in a log and plotted on a control chart. Appropriate

distributes calibrated radioactivity standards primarily to laboratories involved in radiological environmental monitoring. Additionally, seven major radiopharmaceutical manufacturers (some of which supply radioactivity standards commercially) participate in a MAP organized by the Atomic Industrial Forum and NBS. In this MAP, NBS distributes standards as test samples to the manufacturer (second mechanism) and receives certified samples from the manufacturer for verification by NBS (first mechanism).

Measurement assurance interactions that use the first mechanism are available via special NBS calibration services. NBS will, on request and for a fee, perform calibrations of representative samples of standards provided by the supplier for NBS confirmation of the supplier's reported values. Calibration services are available for a large variety of radionuclides provided certain requirements (as to sample stability and suitable activity range) are met. Measurement assurance interactions that use the second mechanism are available via the issuance of test standards by NBS. For a nominal charge (beyond the price of the standard), NBS radioactivity Standard Reference Materials (SRMs) can be purchased as test sources of undisclosed activity that can be used to demonstrate agreement, within certain specified limits, between the source supplier's measurements and those of NBS. A Report of Test (for the first mechanism) or a Report of Measurement (second mechanism), containing both the source supplier's and NBS values, is issued by NBS to document the source supplier's participation in the measurement assurance activity.

investigative and corrective action should be taken when the measurement value falls outside the predetermined control value.

A check source for determining changes in counting rate or counting efficiency should be of sufficient radiochemical purity to allow correction for decay but need not have an accurately known disintegration rate, i.e., need not be a standard source.

For systems in which samples are changed manually, check sources are usually measured daily. For systems with automatic sample changers, it may be more convenient to include the check source within each batch of samples and thus obtain a measurement of this source within each counting cycle. For proportional counter systems, the plateau(s) or response(s) to the check source(s) should be checked after each gas change. Background measurements should be made frequently, usually daily or before each use, to ensure that levels are within the expected range. For systems with automatic sample changers, background measurements should be included within each measurement cycle.

For alpha- and gamma-ray-spectrometry systems, energy-calibration sources (i.e., a source containing a radionuclide, or mixture of radionuclides, emitting two or more alpha or gamma rays of known energies) are counted to determine the relationship between channel number and alpha- or gamma-ray energy. The frequency of these energy calibration checks depends on the stability of the system but usually is in the range of daily to weekly. The results of these measurements should be recorded and compared to predetermined limits in order to determine whether or not system gain and zero level need adjustment. Adjustments should be made as necessary.

Additional checks needed for spectrometry systems are the energy resolution of the system and the count rate (or counting efficiency) of a check source. These should be determined periodically (usually weekly to monthly for energy resolution and daily to weekly for count rate) and after system changes, such as power failures or repairs, to determine if there has been any significant change in the system. The results of these measurements should be recorded.

## 6.3 Analysis of Quality Control Samples

The analysis of quality control samples provides a means to determine the precision and accuracy of the monitoring processes and includes both intralaboratory and interlaboratory measurements.

The analysis of replicate samples (containing significant detectable activity) provides a means to determine precision; the analysis of

samples containing known concentrations of radionuclides provides a means to determine accuracy. The analysis of laboratory blanks provides a means to detect and measure radioactive contamination of analytical samples, a common source of error in radiochemical analysis of low-level samples. The analysis of analytical blanks also provides information on the adequacy of background subtraction, particularly for environmental samples.

The fraction of the analytical effort needed for the analysis of quality control samples depends to a large extent on (1) the mixture of sample types in a particular laboratory in a particular time period and (2) the history of performance of that laboratory in the analysis of quality control samples. However, for environmental laboratories, it is found that at least 5%, and typically 10%, of the analytical load should consist of quality control samples.

### 6.3.1 Intralaboratory Analyses

Replicate samples, usually duplicates, should be analyzed routinely. These replicates should be prepared from samples that are as homogeneous as possible, such as well-stirred or mixed liquids (water or milk) and solids (dried, ground, or screened soil, sediment, or vegetation; or the ash of these materials). These samples may be replicates of monitoring program samples, replicates of reference test materials, or both. The size and other physical and chemical characteristics of the replicate samples should be similar to those of single samples analyzed routinely.

The analysis of the replicate samples as blind replicates is desirable but is not practicable for all laboratories or for all types of samples. For example, in small laboratories it may not be practicable to prevent the analysts from being aware that particular samples are replicates of one another.

Obtaining true replicates of all types of samples also is not practicable. For example, obtaining replicate samples of airborne materials usually is not practicable on a routine basis because it requires either a separate sampling system or splitting a single sample (e.g., cutting a filter in half). Use of replicate samplers usually is not economically feasible and splitting of samples results in replicates that do not represent the usual sample size or measurement configuration (counting geometry) for direct measurement. However, simulated samples of airborne materials may be prepared in replicate and submitted for analysis as unknowns.

Analysis of intralaboratory blank and spiked samples is an important part of each environmental laboratory's quality control program. To check for contamination from reagents and other sources, known analytical blank samples

should be included frequently in groups of unknown environmental samples that are analyzed radiochemically. Spiked and blank samples should be submitted for analysis as unknowns to provide an intralaboratory basis for estimating the accuracy of the analytical results. These blanks and spikes may include blind replicates.

### 6.3.2 Interlaboratory Analyses

Analysis of effluent and environmental samples split with one or more independent laboratories is an important part of the quality assurance program because it provides a means to detect errors that might not be detected by intralaboratory measurements alone. When possible, these independent laboratories should be those whose measurements are traceable to NBS.<sup>3</sup>

Analysis of split field samples, such as samples of milk, water, soil or sediment, and vegetation, is particularly important in environmental monitoring programs to provide an independent test of the ability to measure radionuclides at the very low concentrations present in most environmental samples.

The NRC Office of Inspection and Enforcement conducts a Confirmatory Measurements Program for laboratories of licensees that measure nuclear reactor effluents. The analyses of liquid waste holdup tank samples, gas samples, charcoal cartridges, and stack particulate filters are included in this program. The results of the licensee's measurements of samples split with the NRC are compared to those of an NRC reference laboratory whose measurements are traceable to the National Bureau of Standards. Thus the results of this comparison provide to the NRC an objective measure of the accuracy of the licensee's analyses.

Laboratories of licensees or their contractors that perform environmental measurements should participate in the EPA's Environmental Radioactivity Laboratory Intercomparison Studies (Cross-check) Program, or an equivalent program. This participation should include all of the determinations (sample medium/radionuclide combinations) that are both offered by EPA and included in the licensee's environmental monitoring program. Participation in the EPA program provides an objective measure of the accuracy of the analyses because the EPA measurements are traceable to the National Bureau of Standards. If the mean result of a cross-check analysis exceeds the control limit as defined by EPA (Ref. 42), an investigation should be made to determine the reason for this deviation and corrective action should be taken

<sup>3</sup>NBS and NRC staffs recognize the need for a clearer definition of the term "traceability" as it applies to radiation and radioactivity measurements. These staffs are working together to develop such a statement, which will be published separately.

as necessary. Similarly, an investigation and any necessary corrective action should take place if the "normalized range," as calculated by EPA, exceeds the control limit, as defined by EPA. A series of results that is within the control limits but that exhibits a trend toward these limits may indicate a need for an investigation to determine the reason for the trend.

#### 6.4 Computational Checks

Procedures for the computation of the concentration of radioactive materials should include the independent verification of a substantial fraction of the results of the computation by a person other than the one performing the original computation. For computer calculations, the input data should be verified by a knowledgeable individual. All computer programs should be documented and verified before initial routine use and after each modification of the program. The verification process should include verification, by a knowledgeable individual, of the algorithm used and test runs in which the output of the computer computation for given input can be compared to "true" values that are known or determined independently of the computer calculation. Documentation of the program should include a description of the algorithm and, if possible, a current listing of the program. Guidelines for the documentation of digital computer programs are given in ANSI N413-1974 (Ref. 43).

#### 7. Quality Control for Continuous Effluent Monitoring Systems

Guidance on specification and performance of onsite instrumentation for continuously monitoring radioactivity in effluents is given in ANSI N13.10-1974 (Ref. 18).

The specified frequency of calibration for a particular system should be based on considerations of the nature and stability of that system. For nuclear power plants, specific requirements for calibrations and checks of particular effluent monitoring systems usually are included in the technical specifications for the plant.

Initial calibration of each measuring system should be performed using one or more of the reference standards that are certified by the National Bureau of Standards or standards that have been obtained from suppliers that participate in measurement assurance activities with NBS (see footnote 2). These radionuclide standards should permit calibrating the system over its intended range of energy and rate capabilities. For nuclear power plants, sources that have been related to this initial calibration should be used to check this initial calibration at least once per 18 months (normally during refueling outages).

Periodic correlations should be made during operation to relate monitor readings to the

concentrations and/or release rates of radioactive material in the monitored release path. These correlations should be based on the results of analyses for specific radionuclides in grab samples from the release path.

Any flow-rate measuring devices associated with the system should be calibrated to determine actual flow rates at the conditions of temperature and pressure under which the system will be operated. These flow rate devices should be recalibrated periodically.

Whenever practicable, a check source that is actuated remotely should be installed for integrity checks of the detector and the associated electrical system.

#### 8. Review and Analysis of Data

Procedures for review and analysis of data should be developed. These procedures should cover examination of data from actual samples and from quality-control activities for reasonableness and consistency. These reviews should be performed on a timely basis. General criteria for recognizing deficiencies in data should be established.

Provisions should be made for investigation and correction of recognized deficiencies and for documentation of these actions.

#### 9. Audits

Planned and periodic audits should be made to verify implementation of the quality assurance program. The audits should be performed by individuals qualified in radiochemistry and monitoring techniques who do not have direct responsibilities in the areas being audited.

Audit results should be documented and reviewed by management having responsibility in the area audited. Followup action, including reaudit of deficient areas, should be taken where indicated.

#### D. IMPLEMENTATION

The purpose of this section is to provide information to applicants and licensees regarding the NRC staff's plans for using this regulatory guide.

Except in those cases in which the applicant or licensee proposes an acceptable alternative method, the staff will use the methods described herein in evaluating an applicant's or licensee's capability for and performance in complying with specified portions of the Commission's regulations after March 30, 1979.

If an applicant or licensee wishes to use the method described in this regulatory guide on or before March 30, 1979, the pertinent portions of the application or the licensee's performance will be evaluated on the basis of this guide.

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## GLOSSARY

**Accuracy**-a qualitative concept in the statistical treatment of measurement data used to describe the agreement between the central tendency of a set of numbers and their correct value (or the accepted reference value). It is also used to describe the agreement between an individual value and the correct value (or the accepted reference value).

**Analytical Blank (Sample)**-ideally, a sample having all of the constituents of the unknown sample except those to be determined. In radioanalytical practice, the term often refers to the radiochemical processing of carrier(s) or tracers without the sample matrix material.

**"Blind" Replicate (Sample)**-replicate samples that are not identified as replicates to the persons performing the analysis.

**Calibration**-the process of determining the numerical relationship between the observed output of a measurement system and the value, based on reference standards, of the characteristics being measured.

**Calibration Source**-any radioactive source that is used for calibration of a measurement system.

**Check Source (or instrument check source or performance check source)**-a radioactive source used to determine if the detector and all electronic components of the system are operating correctly.

**Instrument Background**-the response of the instrument in the absence of a radioactive sample or other radioactive source.

**Precision**-a qualitative concept in the statistical treatment of measurement data used to describe the dispersion of a set of numbers with respect to its central tendency.

**Quality Assurance (QA)**-the planned and systematic actions that are necessary to provide adequate confidence in the results of a monitoring program.

**Quality Control (QC)**-those quality assurance actions that provide a means to control and measure the characteristics of measurement equipment and processes to established requirements. Thus, quality assurance includes quality control.

**Reference Test Material**-a large batch of homogeneous material from which aliquots may be taken for interlaboratory comparisons or for internal use by the laboratory. The material must be uniform but need not be standardized.

**Spiked Sample**-a sample to which a known amount of radioactive material has been added. Generally, spiked samples are submitted as unknowns to the analysts.

**Split Sample**-a homogeneous sample that is divided into parts, each of which is analyzed independently by separate laboratory organizations.

**Standard (radioactive) Source**-a radioactive source having an accurately known radionuclide content and radioactive decay rate or rate of particle or photon emission.



**EXHIBIT C**

DETERMINATION OF GROSS ALPHA AND/OR GROSS BETA ACTIVITY  
IN WATER SAMPLES

**1.0 INTRODUCTION**

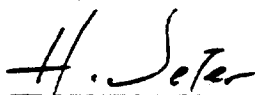
The procedures described in this section are used to measure the overall radioactivity of water samples without identifying the radioactive species present. No chemical separation techniques are involved.

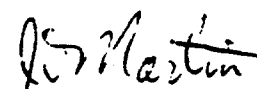
One liter of the sample is evaporated on a hot plate. Different volumes may be used if the sample has a significant salt content as measured by a conductivity meter, or if unusual sensitivity is desired. If requested by the customer, the sample is filtered through No. 54 filter paper before evaporation, removing particles greater than 30 microns in size. 01/20/86

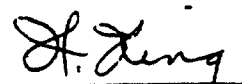
After evaporating to a small volume in a beaker, the sample is rinsed into a 2-inch diameter stainless steel planchet which is stamped with a concentric ring pattern to distribute residue evenly. Final evaporation to dryness takes place under heat lamps. Samples which appear to be hygroscopic are dried again under heat lamps just prior to counting. 01/20/86

Residue mass is determined by weighing the planchet before and after mounting the sample. The planchet is counted for alpha and/or beta activity on an automatic proportional counter. Results are calculated using empirical self-absorption curves which allow for the change in effective counting efficiency caused by the residue mass.

Issue or Revision	Pages	Prepared By	Effective Date	Approved By Vice President Technical	Approved By Manager Quality Assurance
Rev.5	8		03/21/86		

  
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H. King

## 2.0 DETECTION CAPABILITY

Detection capability depends upon the sample volume actually represented on the planchet, the background and the efficiency of the counting instrument, and upon self-absorption of alpha and beta particles by the mounted sample. Because the radioactive species are not identified, no decay corrections are made and the reported activity refers to the counting time.

The minimum detectable level (MDL) for water samples is nominally 1.6 picocuries per liter for gross beta at the 4.66 sigma level (1.0 pCi/l at the 2.83 sigma level), assuming that 1 liter of sample is used and that 1/2 gram of sample residue is mounted on the planchet. These figures are based upon a nominal counting time of 50 minutes and upon representative values of counting efficiency and background of 0.2 and 1.2 cpm, respectively. The MDL for gross alpha activity is nominally 2.3 picocuries per liter at the 4.66 sigma level (1.4 pCi/l at the 2.83 sigma level) also assuming that 1 liter of sample is used and that 1/2 gram of sample residue is mounted on the planchet. These figures are based upon a nominal 200 minute counting time and upon a representative efficiency of 0.02 and a background of 0.1 cpm.

The MDL becomes significantly lower as the mount weight decreases because of reduced self-absorption. At a zero mount weight, the 4.66 sigma MDL for gross beta is 0.9 picocuries per liter and the MDL for gross alpha is 0.3 picocuries per liter. These values reflect a beta counting efficiency of 0.38 and an alpha counting efficiency of 0.18.

## 3.0 SAMPLE SELECTION PROCEDURE

- (a) Using the Sample Receipt Form with the Teledyne Isotopes sample number, locate the sample (or sample group) in the Sample Receiving

Storage Room and transport them to the Alpha-Beta Laboratory.

- (b) Begin filling out the Radiochemical Work Sheet - Gross Beta/Gross Alpha, entering the customer name, the sample numbers in numerical order, the desired analyses (alpha and/or beta), sample collection dates, the sample preparation date and the initials of the analyst.
- (c) Make an entry in the Alpha-Beta Laboratory Data Book showing customer name, sample numbers, sample type, collection dates and desired analyses.

#### 4.0 CONDUCTIVITY MEASUREMENT PROCEDURE

Normally one liter of sample is evaporated for an alpha/beta analysis. A reduced volume must be used if the sample contains a significant concentration of dissolved salts, however, because sample residue must not exceed approximately 1.5 grams in the planchet with the present method of sample mounting and efficiency determination.

The approximate salt content of the sample is inferred at the analyst's option by measuring electrical conductivity. The result is used to determine the proper aliquot of the sample to use for the alpha-beta analysis.

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- (a) Standardize the conductivity meter before processing each batch of water samples. With the conductivity cell clean and dry, turn the meter function switch to the "standardize" position. Turn the bottom knob until the meter reads 7 (also designated "standardize", "battery check").
- (b) Turn the function switch to "conductivity". Dip the conductivity cell into the sample container until approximately 2 inches are immersed. First read on the X10000 scale. If the reading is less than 10,000, switch to the X1000 scale.
- (c) Using the conductivity reading in micromhos, look up the proper sample aliquot on the table provided in the laboratory. Write this aliquot on the sample container with a laboratory marking pen and circle the number. 03/21/86
- (d) Rinse the conductivity cell between readings. Using a beaker as a sink, rinse the cell inside and out with deionized water from a wash bottle.

- (e) After processing a group of samples, rinse the conductivity cell first with deionized water and then with methanol.

## 5.0 SAMPLE PREPARATION PROCEDURES

This section describes how water samples are filtered (if required), then evaporated. The residue of each sample is dried on a 2-inch stainless steel planchet which is stamped with a concentric ring pattern.

- (a) Choose a graduated beaker sized to contain approximately twice the sample aliquot determined in section 4.0 above, for example, a 2-liter graduated beaker for a 1-liter sample size. Mark it with the 5-digit Teledyne Isotopes sample number.
- (b) Shake the sample container to distribute any particulate matter evenly. Decant the desired aliquot into the numbered beaker.
- (c) If filtration is requested by the customer, obtain another beaker of the same size and write the sample number on it. Place a glass funnel in a funnel rack over the empty beaker. Fold a 18.5 cm diameter No. 54 filter paper disk into quarters and place it in the mouth of the funnel. Gravity filter the sample from its original beaker into the identically numbered beaker. Rinse the original beaker and the filter paper with deionized water from a wash bottle.
- (d) Add approximately 1 ml concentrated  $\text{HNO}_3$  to the sample from a dropping bottle. Place the beaker on a hot plate under the hood in the Alpha-Beta Laboratory and set the hot plate for high (700°F setting) surface temperature.
- (e) Evaporate the sample until the volume is reduced to 1-5 ml. Take care to reduce hot plate temperature as the sample volume decreases in order to avoid loss by spattering from the beaker. Remove from the hot plate.
- (f) Prepare a 2-inch stainless steel concentric ring planchet for each water sample by first wiping it clean with a Kimwipe. Write sample number, customer name, and desired analyses (alpha and/or beta) on a gummed label and stick to back of planchet.
- (g) Take the labeled group of planchets to the Radiochemistry Counting Room on a sample tray and weigh each on the analytical balance. Record this tare weight in the Alpha-Beta Laboratory Data Book beside the sample number.
- (h) Return the tray of tared planchets to the Alpha-Beta Laboratory. Using a rubber policeman mounted on a glass stirring rod, police

the interior sides and bottom of each beaker thoroughly to bring any adhering material into suspension in the liquid. Transfer the solution from each sample beaker to its correspondingly numbered planchet. Wash the beaker sparingly with deionized water using a wash bottle and collect the washings in the planchet.

- (i) Place the filled planchets in the sample tray under heat lamps in the Light Hood. Add 1 drop of laboratory aerosol to each planchet. Evaporate to dryness. Remove and allow to cool. If any residue is found on the outside edge of a planchet, scrape it off with a spatula and return it into the planchet.
- (j) Take sample tray to the analytical balance within one hour after removing from the Light Hood. Weigh each planchet and record final weight next to the corresponding tare weight in the Alpha-Beta Laboratory Data Book.
- (k) Subtract the tare weight from the final weight for each sample and record this mount weight on the Radiochemical Work Sheet and in the Data Book. Submit the Radiochemical Work Sheet and the tray of finished planchets to the Radiochemistry Counting Room for radio-assay.

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#### 6.0 SAMPLE COUNTING PROCEDURE

Before carrying out the steps below, inspect the residue in the planchets. If these residues appear to have gained moisture from the air, place the tray of planchets under heat lamps and dry again. Then re-weigh the samples before counting.

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- (a) Verify that the sample tray containing a group of sample planchets contains the same sample numbers as the accompanying Radiochemical Work Sheet - Gross Beta/Gross Alpha.
- (b) Write counting sequence numbers on the work sheet following the order that the sample numbers appear on the sheet. Begin with the number 1 if starting a new sample counting group; otherwise use the number which follows the last sequence number assigned.
- (c) Remove the sample planchets from the tray in sequence number order, verifying in each case that the sample number on the back of the planchet matches the sequence number. Transfer each to a plastic planchet holder and then to the counting cassette in sequence number order.
- (d) Write the counting start date and the number of the automatic proportional counter on the work sheet.
- (e) Load the cassette into the counter and set the counting mode for

alpha, beta, or beta-then-alpha as specified on the Radiochemical Work Sheet. Beta counts are normally set for 50 minutes and alpha counts for 50 minutes, but the intervals can be modified to obtain desired sensitivity. 01/20/86

- (f) After all samples in the group have been counted, copy the printed counts and counting interval for each sample onto the Radiochemical Work Sheet in the space provided.
- (g) Unload the sample planchets from the holders and store in the rack for processed alpha and beta samples.

## 7.0 CALCULATION OF THE SAMPLE ACTIVITY OR OF THE MDL

- (a) Sample activity and the 2-sigma counting error are calculated as follows:

$$\frac{\text{Net pCi}}{\text{unit volume}} = \underbrace{\frac{\frac{N}{\Delta t} - \beta}{2.22(v)(\epsilon)}}_{\text{net activity}} \pm \underbrace{\frac{2\sqrt{\frac{N + \beta}{\Delta t}}}{2.22(v)(\epsilon)}}_{\text{counting error}}$$

where: N = total counts from sample (counts)

$\Delta t$  = counting time for sample (min)

$\beta$  = background rate of counter (cpm)

$$2.22 = \frac{\text{dpm}}{\text{pCi}}$$

v = volume of sample analyzed

$\epsilon$  = efficiency of the counter

- (b) Establishing and reporting activities that are equal to or less than the detection limit:

If the net activity  $\left( \frac{\frac{N}{\Delta t} - \beta}{2.22(v)(\epsilon)} \right)$  is equal to or is less than a

designated multiple of the background counting error, the activity is below the limits of detection and is called "less than" (L.T.) or "minimum detectable level" (MDL).

The L.T. value can be specified by stating only the counting error at a predetermined multiple ( $\sigma_m$ ) of the one sigma statistics. A sigma multiple ( $\sigma_m$ ) of 4.66 is used for calculation of the L.T. values unless the customer requests another value such as 2.83.

$$\text{thus L.T.} = \frac{\sigma_m \sqrt{\frac{\beta}{\Delta t}}}{2.22 (v) (\epsilon)}$$

## 8.0 CALIBRATION OF EQUIPMENT FOR GROSS ALPHA, GROSS BETA ANALYSES

Automatic proportional counters are used for measurement of gross alpha and gross beta analyses for all sample media. The preparation of each sample type has been described in separate procedures. The final "mounting" is in a 2-inch steel planchet which is positioned in the counting instrument. Alpha and beta standards are also prepared and measured in 2-inch planchets.

Alpha standards are prepared by diluting EPA Am-241 standard solutions (traceable to NBS) and by evaporating measured aliquots in planchets. The efficiency of the instrument is then determined by dividing the cpm measured by the dpm value. Routine measurements of check sources are plotted on control charts as described in PRO-032-27.

The absorption (called self-absorption) of alphas by the sample mass in the planchet (thus reducing the count rate) is determined as follows: A known activity of Am-241 is evaporated with varying amounts of  $\text{Na}_2\text{CO}_3$  salt. This salt has been shown to have the same self-absorption properties as finely divided silt. Residue weights between 0 and 1.5 grams are distributed in 2-inch planchets. From the radiometric determinations a curve is constructed with the apparent instrument efficiency monotonically decreasing



with increasing "mount weight". An algebraic expression of this curve is stored in a computer and is referenced during data reduction to yield the counting efficiency corresponding to the measured mount weight.

Determinations of beta counting efficiencies and self-absorption curves are similar to the methods used for alpha. Beta standards are prepared by diluting EPA Cs-137 standard solutions (traceable to NBS). Measured aliquots of these solutions are evaporated in planchets to prepare standards in the same geometry used for counting samples. Self-absorption curves are prepared by evaporating standard solutions with varying weights of  $\text{Na}_2\text{CO}_3$  salts. Beta check sources are counted routinely and the results are plotted on control charts as described in PRO-032-027.



DETERMINATION OF PLUTONIUM, URANIUM, AMERICIUM,  
CURIUM AND THORIUM BY ALPHA SPECTROSCOPY

1.0 INTRODUCTION

This document presents a sequential radiochemical procedure for analyzing various alpha-emitting nuclides by alpha spectroscopy using isotope dilution methods. It applies to aqueous samples as well as to solids such as soils and sediments, air particulate filters and swipes.

Measured quantities of the appropriate isotope dilution spikes (Pu, U, Am, Cm, Th) are first added to an aliquot of the sample. Solid samples are leached in nitric acid and filtered. For aqueous samples, the alpha emitting nuclides are co-precipitated with iron hydroxide. In all cases the prepared sample is dissolved in 7N HNO<sub>3</sub> and passed through an anion exchange column. The effluent is saved for U, Am, and Cm processing.

Thorium is stripped from the column using 9N HCl, then plutonium is stripped using 1N HNO<sub>3</sub> followed by 5% hydroxylamine hydrochloride solution. These portions are evaporated, then dissolved in 0.1N HNO<sub>3</sub> and electroplated onto stainless steel discs.

The original column effluent is evaporated, dissolved in 9N HCl, then passed through another anion exchange column. The effluent is converted to 0.1N HNO<sub>3</sub> solution and is electroplated onto a stainless steel disk for Am and Cm analysis.

Iron is stripped from the second column using HCl and HI solution. Then uranium is stripped from the column using 0.1N HCl. This effluent is

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converted to 0.1 N  $\text{HNO}_3$  and is electroplated onto a stainless steel disc for uranium analysis.

Electroplated discs are assayed on an alpha spectrometer equipped with surface-barrier silicon diode detectors which are housed in vacuum chambers. The energy regions corresponding to the desired nuclides are integrated (determined by analyzing isotopic standards). The isotope dilution spike peak is also integrated and is used in the calculation of sample activity in order to quantify chemical yield and counting efficiency.

## 2.0 DETECTION CAPABILITY

Detection capability depends upon the sample aliquot used in the analysis, the background and efficiency of the counting instrument, and upon the counting interval.

The minimum detectable level (MDL) for alpha-emitting nuclides in soil, sediment or solid samples is nominally  $1.7 \times 10^{-2}$  pCi/gm at the 4.66 sigma level ( $1.0 \times 10^{-2}$  pCi/gm at the 2.83 sigma level). These figures are based on a 10 gm aliquot of sample, a chemical yield of 0.20 (lower than for other sample types), a counting efficiency of 0.20, a counting interval of 1000 minutes and a background of 0.01 cpm. The MDL for environmental water samples is nominally  $1.3 \times 10^{-1}$  pCi/l at the 4.66 sigma level ( $8 \times 10^{-2}$  pCi/l at the 2.83 sigma level). These are based on a 0.5l aliquot of sample, a chemical yield of 0.5, and other parameter values as stated above.

For in-plant liquids the nominal MDL is  $6.6 \times 10^{-9}$  uCi/ml at the 4.66 sigma level ( $4.0 \times 10^{-9}$  uCi/ml at the 2.83 sigma level). These values are based on a 10 ml aliquot of sample, a chemical yield of 0.5 and other parameters as stated above. Finally, the nominal MDL for air particulate filters or swipes is  $6.6 \times 10^{-2}$  pCi per sample at the 4.66 sigma level ( $4.0 \times 10^{-2}$  pCi per sample at the 2.83 sigma level). In this case



the sample aliquot is taken as unity, with other parameters assigned as with liquid samples.

### 3.0 SAMPLE SELECTION PROCEDURE

- (a) Using the Sample Receipt Form with the Teledyne Isotopes sample number, locate the sample (or sample group) in the Sample Receiving and Storage Room and transport them to the Alpha Spectroscopy Laboratory.
- (b) Make an entry in the Laboratory Data Book showing customer name, sample numbers, sample type, nuclides to be analyzed, isotope dilution spikes used and the date of starting the samples.
- (c) Begin filling out a data sheet for each sample, showing sample number, customer and sample type.

### 4.0 SAMPLE PREPARATION PROCEDURES

This section describes how the various sample types are aliquoted and prepared for chemical separations. Wear a laboratory coat and safety glasses. Wear disposable gloves when working with acids.

#### 4.1 Preparation of Soil, Sediment or Solid Samples

- (a) Write the Teledyne Isotopes sample number on a watch glass or beaker using a laboratory marking pen. Scoop approximately 30 grams of sample onto it using a spatula. Place under heat lamps until dry.
- (b) Write the sample number on a 150 ml beaker using a laboratory marking pen. Obtain its tare weight using a beam balance or a top-loading balance. Using a spatula, add dried sample to the beaker until the balance indicates 10.0 grams more than the tare weight, resulting in 10.0 grams of sample in the beaker (different aliquot weights may be taken according to availability of sample or desired sensitivity). Write the aliquot weight in the Laboratory Data Book and on the data sheet.
- (c) Add conc (70%)  $\text{HNO}_3$  to the sample beaker filling to the 30 ml mark.

Note: If neither Pu nor Th analyses are required, leach with conc HCl rather than  $\text{HNO}_3$ . Proceed with steps (d) through (h) but substitute 9N HCl for the 7N  $\text{HNO}_3$ . Then skip to section 5.2 for processing on the

second ion exchange column (hydrochloric acid medium)

- (d) Add 1 ml of standardized isotope dilution spike to the sample for each analysis desired according to the following table. Use a separate, disposable 1 ml pipet for each spike.

<u>Analysis</u>	<u>Spike</u>
Pu-238, 239, 241	Pu-236 or Pu-242
Am-241, Cm-242, Cm-244	Am-243
U-234, 235, 238	U-232
Th-230	Th-232
Th-232	Th-230
Th-228	Th-230 or Th-232

Note: If both the Th-230 and Th-232 analyses are desired, two aliquots of sample must be prepared because each isotope is used as a spike for the other analysis.

- (e) Stir the sample with a glass rod. Place the beaker under heat lamps and allow to leach for approximately 2 hours.
- (f) Fold a glass fiber filter disc into quarters to make a cone and place it in a glass funnel. Mark the sample number on another 150 ml beaker and place it under the funnel in a filter rack. Gravity filter the sample. Rinse the solids with 7N HNO<sub>3</sub> and collect the washings with the filtrate. Discard the filter and solids.
- (g) Place the sample beaker under heat lamps and evaporate to dryness.
- (f) Add 20 ml 7N HNO<sub>3</sub> to the sample beaker. Stir until residue is dissolved.
- (h) Proceed to section 5.0 for chemical separations.

#### 4.2 Preparation of Environmental Water Samples

- (a) Write the Teledyne Isotopes sample number on a clean 1-liter beaker. Decant sample into the beaker, filling to the 500 ml mark (different aliquot sizes may be taken according to availability of sample or desired sensitivity).
- (b) Add 1 ml of standardized isotope dilution spike to the sample for each analysis desired according to the table in 4.1 (d) above. Use a separate disposable 1 ml pipet for each spike.
- (c) Add a dropperful of Fe carrier to the sample tube. Stir with a glass rod.



- (d) Add conc  $\text{NH}_4\text{OH}$  slowly from a dropping bottle while stirring. Test with pH paper and continue adding  $\text{NH}_4\text{OH}$  until the sample is basic (blue indication). A dispersed brown iron hydroxide precipitate will form.
- (e) Fold a glass fiber filter disc into quarters to make a cone and place it in a glass funnel. Mark the sample number on the funnel using a laboratory marking pen. Place another 1-liter beaker (unmarked) under the funnel. Gravity filter the sample. Rinse the precipitate into the center of the filter cone using a wash bottle containing deionized water which has been made basic with a few drops of ammonium hydroxide.
- (f) Discard the filtrate and save the filter in its numbered funnel. Mark the sample number on a 150 ml beaker and place under the funnel. Pour 30 ml of 7N  $\text{HNO}_3$  into the filter. This will dissolve the precipitate and bring the accompanying nuclides into the marked 150 ml beaker.

Note: If neither Pu nor Th analyses are required, use 9N HCl rather than 7N  $\text{HNO}_3$  to dissolve the precipitate. Then proceed to Section 5.2 for processing on the second ion exchange column (hydrochloric acid medium).

- (g) Proceed to section 5.0 for chemical separations.

#### 4.3 Preparation of Air Particulate Filter, Swipe, or Solid Samples

- (a) Write the Teledyne Isotopes sample number on a clean 150 ml beaker.
- (b) Place an aliquot of the sample in the beaker. For air particulate filters and swipes, the aliquot could be the whole sample or a fraction of it (depending upon whether other fractions are needed for other analyses). Record the aliquot fraction in the laboratory data book. For solid samples a mass aliquot is determined by weighing the beaker, adding some sample (up to 20 grams), then reweighing. Record the aliquot weight in the laboratory data book.

Note: In some cases the sample is leached and diluted volumetrically in another laboratory. In this case, take an aliquot of the diluted sample using a 10 ml disposable pipet. Record the aliquot taken and the dilution information in the laboratory data book. Proceed to step (d).

- (c) Add conc. (70%)  $\text{HNO}_3$  to the beaker, filling to the 30 ml mark.

Note: If neither Pu nor Th analyses are required, leach with conc HCl rather than  $\text{HNO}_3$ . Proceed with steps (d) through (g) but substitute 9N HCl for the 7N  $\text{HNO}_3$ . Then skip to section 5.2 for processing on the second ion exchange column (hydrochloric acid medium).

- (d) Add 1 ml of standardized isotope dilution spike to the sample for each analysis desired according to the table in 4.1 (d) above. Use a separate, disposable 1 ml pipet for each spike.
- (e) Stir the sample with a clean glass rod. Place under heat lamps and evaporate to dryness.
- (f) Add 20 ml 7N  $\text{HNO}_3$  to the sample. Stir to suspend solids.
- (g) Fold a glass fiber filter disc into quarters to make a cone and place it in a glass funnel. Mark the sample number on another 150 ml beaker and place it under the funnel in a filter rack. Gravity filter the sample. Rinse the solids with 7N  $\text{HNO}_3$  and collect the washings with the filtrate. Discard filter and solids.
- (h) Proceed to section 5.0 for chemical separations.

#### 4.4 Preparation of In-Plant Aqueous Samples

- (a) Write the Teledyne Isotopes sample number on a centrifuge tube. Using a disposable pipet, transfer 10 ml of sample to the beaker (different aliquot sizes may be taken according to availability of sample or desired sensitivity). Write the aliquot in the laboratory data book.
- (b) Add 1 ml of standardized isotope dilution spike to the sample for each analysis desired according to the table in 4.1 (d) above. Use a separate, disposable 1 ml pipet for each spike.
- (c) Add a dropperful of Fe carrier to the sample tube. Stir with a glass rod.
- (d) Add conc  $\text{NH}_4\text{OH}$  slowly from a dropping bottle while stirring. Test with pH paper and continue adding  $\text{NH}_4\text{OH}$  until the sample is basic (blue indication). A dispersed brown iron hydroxide precipitate will form.
- (e) Centrifuge the sample for 5 minutes or longer. Pour the supernate into a radwaste beaker.
- (f) Add approximately 3 ml conc.  $\text{HNO}_3$  to the sample from a dropping bottle. Stir with a glass rod to bring solids into solution.

Note: If neither Pu nor Th analyses are required, use conc HCl rather than conc HNO<sub>3</sub> to dissolve the precipitate. Proceed to step (g) but substitute 9N HCl for the 7N HNO<sub>3</sub>. Then proceed to section 5.2 for processing on the second ion exchange column (hydrochloric acid medium).

- (g) Add 20 ml 7N HNO<sub>3</sub> and stir the sample.
- (h) Proceed to section 5.0 for chemical separations.

## 5.0 CHEMICAL SEPARATION PROCEDURES

This section describes how the various nuclide fractions are separated using ion exchange columns. The effluents are saved in labeled beakers and are then prepared for electroplating. Wear a laboratory coat, safety glasses and disposable gloves when working with strong acids.

### 5.1 First Ion Exchange Column Separations (nitric acid medium)

- (a) Obtain a 1/2" diameter 10-inch length ion exchange column surmounted by a 200 ml reservoir and equipped with a stopcock at the bottom. Insert a small wad of glass wool above the stopcock.
- (b) Make a slurry of 1-X2 (100-200 mesh) resin and water in a beaker. With the column stopcock open, pour the slurry into the column until the resin occupies the lower half.
- (c) Condition the column by passing about 50 ml of 7N HNO<sub>3</sub> through the resin. Collect effluent in a beaker, then discard it.
- (d) Write the sample number and the designation "U, Am, Cm" on a 150 ml beaker and place it under the prepared column. Pass the correspondingly numbered sample through the column at full flow rate. Collect the effluent in the numbered beaker. Make an entry in the Column Record Book showing sample number, corresponding column number, and the date and time the sample flow was started.
- (e) Wash the column by passing 50 ml of 7N HNO<sub>3</sub> through it at full flow rate. Collect the effluent in the same numbered beaker. Save this beaker for U, Am and Cm processing (section 5.2).
- (f) If thorium analysis is required, pass 50 ml 9N HCl through the





column. Collect the effluent in another 150 ml beaker marked with the sample number and the designation "Th". Save this beaker for further processing in section 5.3.

- (g) Strip Pu from the column by passing 20 ml 1N HNO<sub>3</sub> through it, followed by 50 ml 5% NH<sub>2</sub>OH·HCl solution. Catch both effluents in a 150 ml beaker marked with the sample number and the designation "Pu". Save this beaker for further processing in section 5.3.

## 5.2 Second Ion Exchange Column Separations (Hydrochloric acid medium)

- (a) The sample fraction designated "U, Am, Cm" from step 5.1 (e) above requires further column separation. First place the beaker under heat lamps and evaporate to dryness.
- (b) Add approximately 2 ml conc. HCl to the beaker and again evaporate to dryness.
- (c) Repeat step (b).
- (d) Add 20 ml 9N HCl to the sample beaker. Stir with a glass rod to dissolve solids.
- (e) Obtain a 1/2" diameter 10-inch length ion exchange column surmounted by a 200 ml reservoir and equipped with a stopcock at the bottom. Insert a small wad of glass wool above the stopcock.
- (f) Make a slurry of 1-X2 (100-200 mesh) resin and water in a beaker. With the column stopcock open, pour the slurry into the column until the resin occupies the lower half.
- (g) Condition the column by passing about 50 ml of 9N HCl through the resin. Collect effluent in a beaker, then discard it.
- (h) Write the sample number and the designation "Am, Cm" on another 150 ml beaker and place it beneath the conditioned column. Pass the correspondingly numbered sample (designated "U, Am, Cm") through the column at full flow rate. Collect the effluent in the numbered beaker designated "Am, Cm". Make an entry in the Column Record Book showing sample number, corresponding column number, and the date and time the sample flow was started.
- (i) Wash the column by passing 20 ml 9N HCl through it. Collect the effluent in the "Am, Cm" beaker. Set this beaker aside for further processing in section 5.3.



- (j) Place an un-numbered beaker under the ion exchange column. Elute Fe from the column with 30 ml HCl/HI solution (freshly prepared with a ratio of 1 ml conc HI per 9 ml of 6N HCl). Discard the effluent.
- (k) Wash the column with 15 ml of 6N HCl. Discard the effluent.
- (l) Write the sample number and the designation "U" on a 150 ml beaker and place it beneath the column. Elute U from the column using 50 ml of 0.1 N HCl. Set the beaker aside for further processing in section 5.3.

### 5.3 Preparation of Separated Solutions for Electroplating

- (a) Collect the beakers containing separated sample solutions as derived from steps 5.1 (f), (g) and 5.2 (i), (l). Place beakers under heat lamps and evaporate to dryness.
- (b) Add approximately 2 ml conc.  $\text{HNO}_3$  to each beaker and again evaporate to dryness.
- (c) Repeat step (b).
- (d) Add 10 ml 0.1N  $\text{HNO}_3$  to each beaker. Stir with a glass rod to dissolve residue.

### 6.0 ELECTROPLATING PROCEDURE

- (a) Place a 1-inch stainless steel disc on the "0" ring of an electroplating cell. Add the stainless steel contact disc and close the contact blade.
- (b) Transfer the sample solution to the cell, rinsing the beaker with 2 or 3 ml of 0.1 N  $\text{HNO}_3$  from a wash bottle. Mount the cell on the correspondingly numbered plating apparatus.
- (c) Make an entry in the plating record book showing the cell number, the sample number, and the element being analyzed (Pu, U, Am/Cm, Th). Also enter the date and time of plating.
- (d) Turn the current control until 0.5 amperes is indicated on the meter. Allow to electroplate for 1 hour.
- (e) After 1 hour, add 1 ml conc.  $\text{NH}_4\text{OH}$  to the cell and wait 1 minute before turning off current.
- (f) Remove the plating cell and dismantle it. Use tweezers to grasp the edge of the disc and rinse with distilled water.

- (g) Place the disc (deposit side up) on a watchglass. Write a gummed label showing sample number and analysis. Attach this label to the watchglass. Place under heat lamps to dry for 1 hour.

## 7.0 SAMPLE COUNTING PROCEDURE

Electroplated discs are assayed on an alpha spectrometer equipped with surface barrier silicon diode detectors which are housed in vacuum chambers. The energy regions corresponding to the desired nuclides are integrated (determined by analyzing isotopic standards). The isotope dilution spike peak is also integrated and is used in the calculation of sample activity in order to quantify chemical yield and counting efficiency.

- (a) On the Canberra 7404 system, turn the switch from "pump" to "vent"; proceed to step (b). On the Ortec system slowly turn the potentiometer to 0.0, then turn the power supply from NEG to OFF. Turn off the vacuum guage and close valve to vacuum pump. Slowly let in air to the detector chamber using the vent valve.
- (b) Open the front end of the detector chamber. Remove the previous sample and insert the new sample.  
  
Make an entry in the Counting Record log showing the correspondence of detector number to sample number.
- (c) Close the front of the vacuum chamber.
- (d) On the Canberra 7404 system, switch from "Vent" to "Pump". The bias voltage will automatically switch on when the chamber pressure decreases below 50 microns; proceed to step (e). For the Ortec system, close the vent valve and open the pump valve. Turn on the vacuum guage after the pump stops "gurgling". When chamber pressure has been reduced to 12 microns or less, turn the power supply to NEG and slowly turn the potentiometer to 1.0 (100 volts) and lock it.
- (e) Clear the memory of the multichannel analyzer. Initiate the count by pushing the "START" or "COLLECT" button.
- (f) When the desired counting interval has elapsed (nominally 1000 minutes), stop data acquisition by pressing the "STOP or COLLECT" button on the multichannel analyzer. Print out the counting results for each detector: inclusive channel numbers and integrated counts for each peak region. Enter the date on this sheet and save it.

- (g) Using the laboratory notebook, the plating record and the counting printout, complete the data sheet for each sample. Enter the aliquot used in the analysis, the counting interval, and the integrated counts for each nuclide being analyzed. Also, enter the counts resulting from the isotope dilution spikes and the activities of these spikes. Enter the counting dates, the unit code desired for results, and the initials of the analyst. Enter the background counts and counting interval for each peak region as derived from the background log.

Note: The electroplated Pu disc may be subsequently counted by liquid scintillation for Pu-241 (a beta emitter). Refer to procedure PRO-052-84.

## 8.0 CALCULATION OF THE SAMPLE ACTIVITY OR OF THE MDL

Calculation of results is performed by computer according to the algorithms below. Chemical yield and counting efficiency do not appear explicitly in these equations; their combined effects result from the measurement of the isotope dilution peak.

- (a) Sample activity and the 2 sigma counting error are calculated as follows:

$$\frac{\text{Net pCi}}{\text{unit volume or weight}} = \underbrace{\frac{A_{sk} \left( \frac{N_s}{\Delta t_s} - \frac{N_B}{\Delta t_B} \right)}{V \frac{N_{sk}}{\Delta t_s}}}_{\text{net activity}} \pm \underbrace{\frac{2A_{sk} \sqrt{\frac{N_s}{(\Delta t_s)^2} + \frac{N_B}{(\Delta t_B)^2}}}{V \frac{N_{sk}}{\Delta t_s}}}_{\text{counting error}}$$

where:  $N_s$  = integrated counts of sample  
in the peak region of the  
nuclide being analyzed (counts)

$\Delta t_s$  = duration of sample count (sec).

Note: The duration of the isotope dilution peak count is the same as  $\Delta t_s$  because both nuclides are plated on the same disc.

$N_B$  = integrated counts of blank in the peak region of the nuclide being analyzed (counts)

$\Delta t_B$  = duration of blank count (sec)

$N_{sk}$  = integrated counts of the isotope dilution peak from the sample disc (counts)

$A_{sk}$  = activity of the isotope dilution spike used in the analysis (pCi)

$V$  = volume or weight of the sample aliquot used in the analysis

(b) Establishing and reporting a detection limit:

If the net activity (defined above) is equal to or less than a designated multiple of the background counting error, the activity is below the limits of detection and a MDL ("minimum detectable level") or a L.T. ("less than") is reported.

The LT value can be specified by stating a predetermined multiple ( $\sigma$ ) of the background counting error. A multiple of 4.66 is used for the calculation of LT values unless the customer requests another value such as 2.83.

$$\text{thus } LT = \frac{\sigma A_{sk} \sqrt{N_B}}{V \frac{N_{sk}}{\Delta t_s} \Delta t_B}$$

Note: When analyzing for Th-230 and using Th-232 as an isotope dilution spike, a correction must be made for the fraction of Th-230 present in the spike.

DETERMINATION OF RA-226 IN WATER

1.0 INTRODUCTION

The procedure describes the method of determining Ra-226 in water samples by the emanation technique. Radon-222 is equilibrated with the parent radionuclide, Ra-226, and then transferred through a closed system to an evacuated one-liter alpha chamber. The Rn-222 and daughters activities are measured in successive counting periods for an eighteen hour period.

2.0 DETECTION CAPABILITY

The minimum detectable level (MDL) for water samples is nominally 0.1 pCi/l for Ra-226 at the 4.66 sigma confidence level. This figure is based upon a sample volume of 0.5l, a counting time of 1000 minutes, and upon representative values of counting efficiency (for Rn-222 and two alpha emitting daughters) and background of 2.45 and 2.3 cpm, respectively.

11/05/86

3.0 SAMPLE SELECTION PROCEDURE

- (a) Using the Sample Receipt Form with the Teledyne Isotopes sample number, locate the sample (or sample group) in the Sample Receiving and Storage Room. Transport the sample(s) to the Gas Analysis Laboratory.
- (b) Begin filling out the Calculation Sheet -- Ra-226 Gas Counting form, entering the customer name, the sample number, sample collection date, the sample preparation date and the initials of the analyst.

4.0 SAMPLE PREPARATION PROCEDURES

- (a) Transfer 0.5l of water to a labeled emanation flask and close the flask from the atmosphere through the tapered, ground seal. Different volumes of sample may be used in order to

11/05/86

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Issue	(See original for 1976-1983 signatures)				
Rev. 3	4		11/05/86		

*J. D. Martin*  
J. D. Martin

*H. W. Jeter*  
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*H. G. King*  
H. G. King

## DETERMINATION OF RA-226 IN SOIL

### INTRODUCTION

The initial preparation of a soil sample for Ra-226 determination by the emanation technique is to transfer one gram of dry soil into a labeled emanation flask. To that are added 10 ml of 6N HCl and 340 ml of distilled water. Close the flask from the atmosphere through the tapered, ground seal. Proceed with step 4.0 (b) of PRO-022-65.

obtain different minimum detection levels and depending on the availability of sample volume. 11/05/86

- (b) Connect flask to helium supply and pass helium for ten minutes through the fritted disk. The bubbling from the frit purges radon from the sample.
- (c) Close the two stopcocks on the emanation flask.
- (d) Set flask aside for two weeks to permit the Rn-222 activity to equilibrate with the Ra-226, if any, in the water.

#### 5.0 DETECTOR LOADING

After two weeks, proceed with following steps.

- (a) Attach the flask to an evacuated 1ℓ volume alpha counting chamber through the gas handling system.
- (b) Open the stopcock on the flask which will permit Rn-222 (and any residual He) to pass into the 1ℓ counting chamber.
- (c) After ten minutes attach the He supply to the other stopcock and open stopcock and flow He through the frit, water sample and into the 1ℓ counting chamber until a pressure of one atmosphere is reached on the vacuum gauge. This step and step (b) transfers Rn-222 from the water sample to the counting chamber.
- (d) Close the vacuum valve attached to the 1ℓ counting chamber.

#### 6.0 SAMPLE COUNTING

- (a) Turn on high voltage power supply and adjust voltage to pre-determined counting voltage.
- (b) After two minutes, erase any counts on the scaler and push the start accumulation button. Record the start time. 11/05/86
- (c) Record Count at 60 minute intervals until ingrowth of Rn-222 daughters is complete as indicated by a maximum count. If activity is indicated by the count, recount the following day for 60 minutes to verify the presence of Rn-222 by the decay.

#### 7.0 STANDARDS AND CONTROL OF COUNTERS

- (a) A Ra-226 standard which is NBS traceable, is counted in the same manner as described above once per month. The efficiency of the combined radon extraction from the sample and the nuclear counting is determined with the standard. Record the results on a chart.





## 8.0 CALCULATION OF Ra-226 ACTIVITY

The Ra-226 activity is determined from the Rn-222 activity as follows:

$$\frac{\text{Net pCi}}{\text{unit volume}} = \underbrace{\frac{\left(\frac{N}{\Delta t} - \beta\right)e^{\lambda t_2}}{2.22(v)(\epsilon)(1-e^{-\lambda t_1})}}_{\text{net activity}} \pm \underbrace{\frac{2\left(\sqrt{\frac{N + \beta}{\Delta t}}\right)e^{\lambda t_2}}{2.22(v)(\epsilon)(1-e^{-\lambda t_1})}}_{\text{counting error}}$$

10/04/83

where: N = total counts from sample (counts)

$\Delta t$  = counting time for sample (min)

$\beta$  = background rate of counter (cpm)

$2.22 = \frac{\text{dpm}}{\text{pCi}}$

v = volume of sample analyzed

$\epsilon$  = efficiency of the counter

$(1-e^{-\lambda t_1})$  = determines the "ingrowth" of Rn-222 from Ra-226 during the time lapse of  $t_1$

$t_1$  = the time lapse of the first helium purge to the second helium purge

$\lambda$  = the decay constant for Rn-222

$e^{\lambda t_2}$  = the correction for Rn-222 decay from the mid count time to the time it was transferred to the counting chamber

$t_2$  = the time lapse from transfer to chamber to mid count time

Establishing and reporting activities that are equal to or less than the detection limit:

If the net activity is equal to or is less than a specified multiple of the background counting error, the activity is below the limits of detection and is called "less than" (L.T.) or "minimum detectable level" (MDL).

The L.T. value can be specified by stating only the counting error at a predetermined multiple ( $\sigma_m$ ) of the one sigma statistics. A sigma multiple ( $\sigma_m$ ) of 4.66 is used for calculation of the L.T. values unless the customer requests another value such as 2.83.

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$$\text{thus L.T.} = \frac{\sigma_m \sqrt{\frac{B}{\Delta t}} \left( e^{\lambda t_2} \right)}{2.22(v)(\epsilon)(1-e^{-\lambda t_1})}$$

DETERMINATION OF RADIUM-228  
IN WATER SAMPLES

**1.0 INTRODUCTION**

This procedure presents a radiometric method for determining Ra-228 activity in water samples. Stable barium carrier is added to the sample and radium is co-precipitated with barium sulfate. The precipitate is collected by vacuum filtration and is mounted on a nylon planchet. The planchet is counted on a  $\beta$ - $\gamma$  coincidence system for the 909-967 KeV complex peak of the supported daughter product Ac-228. This method is similar to that developed by McCurdy and Mellor at Yankee Atomic Electric Company, Westborough, Massachusetts.

01/20/83

**2.0 DETECTION CAPABILITY**

Detection capability depends upon sample size, chemical yields during processing, the counting interval, and the efficiency and background of the counting instrument. In the present case radioactive decay need not be considered because the short-lived Ac-228 nuclide analyzed is supported by (in secular equilibrium with) its long-lived parent Ra-228.

The minium detectable level (MDL) for Ra-228 in water samples is nominally 1.0 pci/l at the 4.66 sigma level. This figure is based on one liter of sample, a chemical yield of 0.9, and a counting interval of 500 minutes. A background of 0.03 cpm and an overall efficiency of 0.013 characterize the  $\beta$ - $\gamma$  system for counting the Ra-228 daughter in the 906-967 KeV complex peak region.

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05/28/81	5	H W Jeter	05/28/81	05/28/81	J D Martin
Rev. 1	5	<i>[Signature]</i>	01/20/83	01/20/83	<i>[Signature]</i> X.S.X.

### 3.0 SAMPLE SELECTION PROCEDURE

- (a) Using the Sample Receipt Form with the Teledyne Isotopes sample number, locate the sample (or sample group) in the Sample Receiving and Storage Room. Take them to the Environmental Radiochemistry Laboratory.
- (b) Make an entry in the Laboratory Notebook showing customer name, sample type, sample number, and collection date.

### 4.0 SAMPLE PREPARATION PROCEDURES

- (a) Shake the sample container and decant one liter into a two-liter graduated beaker marked with the sample number.
- (b) Using a volumetric pipet, add two ml standardized barium carrier solution (nominally 15 mg Ba/ml) to the sample and stir with a clean glass rod.
- (c) Gravity filter the sample through a fiberglass filter disc which is folded in quarters and inserted in the mouth of a glass funnel. Collect the filtrate in another two-liter beaker marked with the sample number.
- (d) Place sample beaker on a moderate (300°F) hot plate and heat to near boiling for about 1 hour (do not actually boil).
- (e) Using a disposable pipet, add 3 ml  $K_2SO_4$  carrier. Stir with a glass rod.
- (f) Allow sample beaker to remain on the hot plate for another hour. A fine white precipitate should collect at the bottom of the beaker.
- (g) Remove sample beaker from hot plate and allow to cool to room temperature.

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### 5.0 MOUNTING THE PRECIPITATE

- (a) Prepare a 2.8 cm fiberglass disc for each sample by mounting it on a vacuum filtration apparatus and rinsing with deionized water and methanol.
- (b) Place the prepared discs in 4-way partitioned petri dishes which have been marked with sequence numbers (one number per partition, beginning with 1). Write corresponding sequence numbers beside each sample number entry in the Laboratory Notebook. The sequence number indicates the correspondence between a filter and the sample which will be mounted on it.

- (c) Place petri dishes containing prepared filters in a 100°C hot air oven for 10 minutes or longer to dry. Remove petri dishes and allow to cool.
- (d) Weigh the filter discs on the analytical balance using a clean spatula to handle them. Record this tare weight beside the corresponding sequence number and sample number in the laboratory data book. Take care to replace each filter after weighing in the numbered petri dish partition from which it came.
- (e) Using a laboratory spatula, take the tared filters in sequence number order and transfer to the vacuum mounting apparatus. Wet with deionized water. Using the laboratory data book to establish the correspondence between sequence number and sample number, filter each sample from its beaker onto its corresponding filter paper disc.
- (f) Rinse precipitate on filter with deionized water and then with methanol. Transfer each filter from vacuum mounting apparatus back to the numbered petri dish partition from which it came. Place petri dish in a 100°C hot air oven for 20 minutes or longer.
- (g) Remove petri dish and allow to cool. Weigh filters on the analytical balance within 10 minutes of removing from the oven. Write the weights beside the corresponding sequence numbers in the Laboratory Notebook. Return each filter to its original partition in the petri dish.
- (h) Write the sample number and customer name on a gummed label for each sample. Fix each label to the back of a nylon planchet. Using the laboratory notebook to establish the correspondence between sample number and sequence number, transfer each filter to its planchet and fix in place with a two-inch piece of Mylar film and a nylon ring. Trim excess Mylar with scissors.
- (i) Subtract filter tare weight from final weight for each sample. Divide the difference by the carrier yield figure (written on the barium carrier flask) to obtain chemical yield. Enter the yield percentage in the laboratory notebook.
- (j) Using the laboratory notebook as a guide, begin filling out a Radiochemical Work Sheet for each sample. Enter sample number, analysis, collection date, aliquot used, sample type, chemical yield, date of analysis and analyst's initials. Submit finished planchets and work sheets for  $\beta$ - $\gamma$  assay.

01/20/83

**6.0 SAMPLE COUNTING PROCEDURE**

01/20/83

This section describes the procedure of loading the sample planchet into the beta-gamma coincidence counting system and data acquisition. Allow planchets to stand four days or longer before counting to ensure equilibrium of Ac-228 with Ra-228.

- (a) Check that the high voltage of the P.M. tube for the beta counting circuitry is off.
- (b) Remove steel brick door from the shield.
- (c) Remove the beta counting P.M. tube from the NaI well crystal.
- (d) Unscrew cap and remove previous sample planchet.
- (e) Insert current sample planchet with mylar cover against the plastic scintillator (which is bonded to the P.M. tube).
- (f) Replace cap - finger tight.
- (g) Insert beta counting P.M. tube into the NaI well crystal.
- (h) Reposition steel brick door in front of shield opening.
- (i) Turn on high voltage to the beta counting P.M. tube to 1100 volts.
- (j) Erase any previous spectrum on the multi-channel analyser (MCA).
- (k) Set count duration for 500 minutes.
- (l) Push start acquisition button.
- (m) After 500 minutes data acquisition period, put MCA in region of interest integration mode and integrate the 909-967 KeV region. That region had previously been established with an EPA Ra-228 standard.
- (n) Fill in the sample data sheet including counting date, counting interval, and integrated counts. Also enter the system background and efficiency for counting Ac-228 in the 909-967 KeV region.

01/20/83

**7.0 CALCULATION OF Ra-228 ACTIVITY**

01/20/83

- (a) Activity and the  $2\sigma$  counting error are calculated as follows:

$$A = \underbrace{\frac{\frac{N}{\Delta t} - \beta}{2.22(v)(y)(\epsilon)}}_{\text{net activity}} \pm \underbrace{\frac{2\sqrt{\frac{N + \beta}{\Delta t}}}{2.22(v)(y)(\epsilon)}}_{\text{counting error}}$$

A = activity, pCi/l

N = total counts from sample (counts)

$\Delta t$  = counting time for sample (min)

$\beta$  = background rate of counter (cpm)

$2.22 = \frac{\text{dpm}}{\text{pCi}}$

v = volume of sample analyzed, liter

y = chemical yield

$\epsilon$  = efficiency of the counter

(b) A minimum detectable level (MDL) is reported if the net activity

$\left(\frac{N}{\Delta t} - \beta\right)$  is less than the  $4.66\sigma$  counting error of the background:

$$4.66 \sqrt{\frac{\beta}{\Delta t}}$$

In this case the MDL is calculated as follows:

$$\text{MDL} = \frac{4.66 \sqrt{\frac{\beta}{\Delta t}}}{2.22(v)(y)(\epsilon)} \quad \text{pCi/l}$$

PRO-032-66

DETERMINATION OF ELEMENTAL POTASSIUM  
AND K-40 BY FLAME PHOTOMETRY

1.0 INTRODUCTION

This procedure presents a flame photometry method for analyzing elemental potassium in aqueous solutions. Ashing and leaching techniques are described which extend the analysis to animal and vegetable samples. Potassium-40 activity is calculated through multiplication by the natural abundance ratio (0.83 pCi K-40/mg K).

The aqueous sample is aspirated into a flame photometer which is designed to measure potassium with compensation for matrix interferences based on simultaneous measurement of lithium. Emission readings are referenced to a calibration curve established by reading standard potassium solutions.

2.0 DETECTION CAPABILITY AND PRECISION

The flame photometer gives good results for aqueous samples in the 1-300 ppm potassium range. This is equivalent to 0.8 - 250 pCi/l K-40. The range may be extended by concentrating or diluting the sample before measurement. Water samples may be evaporated to  $\frac{1}{4}$  their original volume to give a detection limit of 0.2 pCi/l K-40.

Vegetation or animal samples are ashed and leached to bring the potassium into solution. A detection limit of 0.002 pCi/gm wet (2 pCi/kg wet) is obtained by assuming 3% ash weight and by dissolving one gram of ash to 100 ml volume.

A precision of  $\pm 5\%$  is assigned to flame photometry results based

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on experience with the instrument. An additional 5% variability is assigned to processes of ashing, leaching and aliquoting, resulting in 10% precision in the final result.

### 3.0 SAMPLE SELECTION PROCEDURE

- (a) Using the Sample Receipt Form with the Teledyne Isotopes sample number, locate the sample (or sample group) in the Sample Receiving and Storage Room. Sign for the sample on the Receiving Room log and transport it to the Environmental Radiochemistry Laboratory.
- (b) Make an entry in the Laboratory Notebook showing customer name, sample type and sample numbers.

### 4.0 SAMPLE PREPARATION PROCEDURES

- (a) For water samples carry out the following steps:
  - 1. Shake the sample container and decant one liter into a two-liter graduated beaker which is marked with the sample number.
  - 2. Add a few ml conc.  $\text{HNO}_3$  from a dropping bottle and place the beaker on a hot plate ( $400^\circ\text{F}$ ) to evaporate.
  - 3. When the sample has evaporated to less than 250 ml, remove the beaker and allow to cool.
  - 4. If significant particulate or solid matter is present, gravity filter the sample through a fiberglass filter disk, collecting the filtrate in an appropriately sized beaker which is marked with the sample number.
  - 5. Pour the sample into a graduated cylinder and dilute to 250 ml with deionized water.
  - 6. Decant the sample into a poly bottle marked with the sample number and submit for potassium analysis.
- (b) For animal or vegetation samples carry out the following steps:
  - 1. Select a one-liter ashing beaker and write its code marking in the laboratory data book beside the sample number. Weigh the beaker using a beam balance and record this tare weight in the Laboratory Data Book.
  - 2. Wearing a disposable plastic glove, transfer portions of the sample to the ashing beaker and compact it until approximately 80% full.

3. Weigh the full beaker on a beam balance. Record this final weight in the Laboratory Notebook. Subtract the tare weight and record the difference. If the sample weight thus obtained is less than 200 grams, add more sample to the beaker and repeat the final weighing and tare subtraction.
4. Place the sample beaker under a heat lamp in a hood and allow to dry overnight. If any moisture is visible near the bottom of the beaker on the next day, prod the sample with a spatula and leave it under the heat lamps until dry.
5. Place the sample beaker in a cool muffle furnace and raise temperature in 200<sup>0</sup>C increments to 550<sup>0</sup>C over several hours. Allow sample to ash overnight, then cautiously open the furnace door. If the sample appears gray and fluffy turn off the furnace and allow to cool. If the sample appears black and granular, or if it glows red in places, continue ashing until a gray ash is obtained.
6. After cooling, return the sample beaker to the Environmental Radiochemistry Laboratory. Weigh on a beam balance and enter the final weight in the Laboratory Notebook. Subtract the beaker tare weight to derive the ash weight and record this figure.
7. Write the sample number on a clean 150 ml beaker and obtain its tare weight on a beam balance. Without removing the beaker, set the balance to indicate 1.0 gram more than the tare weight. Using a spatula, add sample ash to the 150 ml beaker until balance is again obtained, resulting in 1.0 gram of ash. Store the remaining ash in a plastic bag marked with the sample number.
8. Add 1:1 hydrochloric acid to the beaker, filling to the 50 ml mark.
9. Place the beaker on a moderate (200<sup>0</sup>F) hot plate under a hood and cover with a 3½ inch watchglass. Allow to leach for two hours or longer.
10. Remove sample beaker from the hot plate and allow to cool to room temperature. Remove watchglass and rinse the condensed acid into the beaker using a deionized water wash bottle. Add deionized water, filling to the 60 ml mark.
11. Fold a 15 cm No. 42 filter paper disc into quarters to make a cone and place it in a four-inch diameter glass funnel. Mark the sample number on a clean 250 ml beaker and place it under the funnel in a filter rack. Gravity filter the sample. Rinse the solids with deionized water and collect the washings

with the filtrate. Discard the filter and solids.

12. Pour the filtrate into a graduated cylinder and dilute to 100 ml with deionized water.

13. Decant the sample into a poly bottle marked with the sample number and submit for potassium analysis.

#### 5.0 ANALYSIS PROCEDURE

- (a) Choose a set of prepared standard potassium solutions in the concentration range desired (e.g. 1, 5, 10, 30, 50, 100 ppm).
- (b) Adjust the flame photometer to read zero when analyzing a deionized water sample. This is accomplished by turning the zero adjust control while following steps e through g with deionized water substituted for the sample.
- (c) Set the photometer range by adjusting the balance control while reading the most concentrated standard solution (steps e through g). It is convenient to set the reading to a multiple of the standard concentration (e.g. set to 1000 while reading the 100 ppm standard).
- (d) Analyze the other potassium standards and record their emission readings (steps e through g).
- (e) For each sample, use the automatic pipettor to aliquot 1.0 ml of sample solution into a 20 ml Nalgene beaker and add 10.0 ml of internal standard lithium solution (15 milliequivalents/liter Li).
- (f) Place the sample beaker under the photometer aspirator and adjust the lithium nulling control until a zero lithium signal is obtained. Read the potassium emission from the digital display and record it next to the sample number (or standard number).
- (g) Place a beaker of deionized water under the aspirator to clean the capillary after reading each sample.
- (h) It is good practice to re-read potassium standard solutions at intervals within the sample group to check for instrument drift.

#### 6.0 CALCULATION PROCEDURE

- (a) Plot the emission readings of potassium standard solutions (y axis) against concentration (x axis) on linear graph paper. Include all replicate readings of standards.
- (b) Draw a calibration line through the standard readings by eye.

(c) Derive the potassium concentration of samples (ppm K) by referencing the calibration line with emission readings.

(d) For water samples, calculate K-40 activity as follows:

$$A = 0.83 CE$$

where: A = K-40 activity, pCi/l

C = K concentration of solution analyzed, ppm or mg K/l

E = evaporation factor, ratio of final volume to original volume (typically 0.25)

0.83 = natural abundance ratio, pCi K-40/mg K

(e) For animal or vegetation samples, calculate K-40 activity as follows:

$$A = 0.83 \frac{CVF}{G}$$

where: A = K-40 activity, pCi/gm wet

C = K concentration of solution analyzed, ppm or mg K/l

G = weight of ash leached into solution, gm (typically 1 gm)

V = final volume of leach solution, l (typically 0.1l)

F = ash fraction, ratio of ash weight to wet weight of sample (typically 0.03)



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December 18, 1987

RECEIVED

DEC 21 1987

O'BRIEN & GERE  
SYRACUSE, NY

Mr. Douglas M. Crawford  
O'Brien and Gere Engineers, Inc.  
Box 4873  
1304 Buckley Road  
Syracuse, NY 13221

Dear Mr. Crawford:

Enclosed is a copy of our analytical procedure (PRO-032-30) for measurement of Pb-210 in soil samples. For water samples the initial preparation steps are obviously not required. For example in the first sentence of the second paragraph of the Introduction, delete "...the dried sample and it is leached with hot 6N hydrochloric acid" and replace with "...one liter of sample." Then continue with the analysis as outlined in the procedure.

Sincerely,

J. David Martin, PhD  
Vice President - Technical

JDM:cm

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DETERMINATION OF LEACHABLE LEAD-210  
IN SOILS AND SEDIMENTS  
page 1 of 8

PRO-032-30

1.0 INTRODUCTION

The Pb-210 activity of soils and sediments is determined radio-chemically by separating the daughter product Bi-210 and assaying its beta activity. The method presented here measures the Pb-210 fraction from which Bi-210 may be dissolved by leaching with hot hydrochloric acid; activity in the interior of mineral grains may be excluded.

Stable lead and bismuth carriers are added to the dried sample and it is leached with hot 6N hydrochloric acid. The sample is then filtered and the filtrate is evaporated, oxidized with nitric acid, and finally dissolved in 1.8N hydrochloric acid. The solution is passed through an anion exchange column. Lead is eluted first with 9N and 0.02N hydrochloric acid, then bismuth is eluted with 2N sulphuric acid. The bismuth is precipitated as the oxychloride and is collected by vacuum filtration on a 1-inch glass fiber disc. The bismuth yield is determined gravimetrically. The filter disc is mounted on a nylon planchette and covered with a Mylar film and a 3 mg/cm<sup>2</sup> aluminum absorber for beta assay in a low level gas proportional counter. The sample is recounted approximately five days later to check the sample for Bi-210 (5 day half-life) radioactive decay.

2.0 DETECTION CAPABILITY

Detection capability depends upon sample size, chemical yields during processing, counting time, and the efficiency and background of the counting instrument. The minimum detectable level (MDL) for leachable

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Pb-210 in soils and sediments is nominally 0.2 picocuries per gram at the 3 sigma level. This figure is based on a sample weight of 10 grams (dry), a chemical yield of 0.5, and a counting interval of 200 minutes. A counter background of 1.5 cpm and an efficiency of 0.23 for Bi-210 counting (using a 3 mg/cm<sup>2</sup> aluminum absorber) are employed in the calculation.

### 3.0 SAMPLE SELECTION PROCEDURE

- (a) Using the Sample Receipt Form with the Teledyne Isotopes sample number, locate the sample (or sample group) in the Sample Receiving and Storage room. Sign for the samples on the Receiving Room Log and transport them to the Alpha/Beta laboratory.
- (b) Make an entry in the Lead-210 Data Book showing customer name, sample type, sample numbers, and collection dates.

### 4.0 SAMPLE PREPARATION PROCEDURE

This section describes how soil and sediment samples are dried, leached in acid, filtered, evaporated and dissolved to prepare them for chemical separations. Wear a laboratory coat and safety glasses while carrying out the steps below.

- (a) Write the Teledyne Isotopes sample number on the outside of a 6-inch diameter watch glass using a laboratory marking pen.
- (b) Using a clean spatula, scoop approximately 25 grams of sample onto the watch glass. (If analyses other than Pb-210 are required, additional sample may be decanted to accommodate them.)
- (c) Place the watch glass under the heating lamp hood until dry. This process may take several hours. Test for dryness by prodding the sample with a clean glass stirring rod. Remove from the hood and allow to cool.

- (d) Write the sample number and company name on a clean 250 ml beaker. Weigh on a beam balance. Without removing the beaker, set the scale for 10.0 grams more than the tare weight. Carefully scoop the dried sample from its numbered watch glass to the beaker until balance is again achieved, resulting in 10.0 grams of sample in the beaker.
- (e) Add 6N HCl to the beaker, filling to the 100 ml mark. Using separate, labelled carrier pipettes, add 1.00 ml Bi carrier and 1.00 ml Pb carrier to the sample beaker.
- (f) Cover the beaker with a 3½-inch watch glass and place on a moderate (300° F) hotplate. Allow the sample to leach for 2 hours. Remove from the hotplate and allow to cool.
- (g) Fold a 15 cm fiberglass filter disc into quarters to make a cone and place it in a 4-inch diameter glass funnel. Mark the sample number on a clean 400 ml beaker and place it under the funnel in a filter rack. Gravity filter the sample. Rinse the solids with deionized water and collect the washings with the filtrate. Discard the filter and solids.
- (h) Add approximately 2 ml HNO<sub>3</sub> to the sample using a dropping bottle. Place the sample beaker on a moderate (300° F) hotplate and allow to gently evaporate to dryness. Check that the sample does not spatter during evaporation and reduce hotplate temperature if necessary.
- (i) Remove beaker from the hotplate and allow to cool. Dissolve the solids in a few drops of conc. HCl and again evaporate to dryness.
- (j) Add approximately 50 ml 1.8N HCl to the sample beaker and warm gently on a hotplate to dissolve the solids. Add more 1.8N HCl, filling to the 200 ml mark. The sample is now ready for the chemical separation described next.

#### 5.0 CHEMICAL SEPARATION AND PURIFICATION PROCEDURES

- (a) Obtain a ½-inch diameter 10-inch length ion exchange column surmounted by a 200 ml reservoir and equipped with a stopcock at the bottom. Insert a small wad of glass wool above the stopcock.
- (b) Make a slurry of Dowex 1-X8 resin and water in a beaker. With the column stopcock open, pour the slurry into the column until the resin occupies the lower half. Note: new resin is used for each sample.



- (c) Condition the column by passing approximately 60 ml of 1.8N HCl at a flowrate near 6 ml/minute (1 drop per second). Close the stopcock when the liquid level reaches the top surface of the resin.
- (d) Pass the sample solution through the column at a flowrate of approximately 4 ml/minute (1 drop per 1½ seconds). Collect the effluent in a beaker and discard. Close the stopcock when the liquid level reaches the top surface of the resin.
- (e) Exercise caution in this step because of the strong acid used. Pass approximately 150 ml of 9N HCl through the column at a flowrate near 6 ml/minute (1 drop per second) to elute the lead. Collect the effluent in a beaker and discard with caution (unless advised to save the effluent by the laboratory supervisor). Close the stopcock when the liquid level reaches the top surface of the resin. Record the midpoint of the elution period in the laboratory notebook.
- (f) Pass approximately 150 ml of 0.02N HCl through the column at a flowrate near 6 ml/minute (1 drop per second). Close the stopcock when the liquid level reaches the top surface of the resin. Discard the effluent.
- (g) Measure 150 ml of 2N H<sub>2</sub>SO<sub>4</sub> in a graduated cylinder and pass through the column at a flowrate near 6 ml/minute (1 drop per second) to elute the bismuth. Collect the effluent in a clean, labelled 400 ml beaker.
- (h) Adjust the pH to 5 as follows: Add 35 ml conc NH<sub>4</sub>OH to the sample beaker from a graduated cylinder. Add a magnetic stirring bar and place on the pH apparatus (previously standardized with pH 7.0 buffer). Measure the sample temperature and set the pH meter control accordingly. Add dilute NH<sub>4</sub>OH (1:5 in H<sub>2</sub>O) using an eyedropper until a pH of 5 is obtained.
- (i) Remove the sample beaker from the pH apparatus and add 2 ml of 6N HCl using a disposable pipette. Dilute with deionized water, filling to the 350 ml mark.
- (j) Place the sample beaker on a hotplate (approximately 600° F surface temperature) and digest until the large particles white BiOCl precipitate form and circulate in the beaker (approximately ½ hour). Remove from the hotplate and allow to cool.

## 6.0 MOUNTING OF THE PRECIPITATE

- (a) Prepare a 2.8 cm glass fiber filter disc for each sample by mounting it on a vacuum filtration apparatus and rinsing with deionized water and methanol.
- (b) Place the prepared discs in 4-way partitioned petri dishes which have been marked with sequence numbers (one number per partition, beginning with 1). Write a corresponding sequence number beside each sample number entry in the laboratory data book.
- (c) Place petri dishes containing prepared filters in a 100° C hot air oven for 10 minutes or longer to dry. Remove petri dishes and allow to cool.
- (d) Weigh the filter discs on the analytical balance within 5 minutes of removal from the oven, using a clean spatula to handle them. Record this tare weight beside the corresponding sequence number and sample number in the laboratory data book. Take care to replace each filter after weighing in the numbered petri dish partition from which it came.
- (e) Using a laboratory spatula, take the tared filters in sequence number order and transfer to the vacuum mounting apparatus. Wet with deionized water. Using the laboratory data book to establish the correspondence between sequence number and sample number, filter each sample from its beaker onto the corresponding filter disc.
- (f) Rinse precipitate on filter with deionized water and then with methanol. Transfer each filter from vacuum mounting apparatus back to the numbered petri dish partition from which it came. Place petri dish in a 100° C hot air oven for 10 minutes or longer.
- (g) Remove petri dish and allow to cool. Weigh filters on the analytical balance within 5 minutes of removing from the oven. Write the weights beside the corresponding sequence numbers in the laboratory data book. Return each filter to its original partition in the petri dish.
- (h) Write a gummed label for each sample, showing the nuclide (Bi-210), the sample number and the customer. Fix each label to the back of a nylon planchette.
- (i) Using the laboratory data book to establish to correspondence between sample number and sequence number, transfer each filter to its planchette and fix in place with a 2-inch piece of mylar film and a nylon ring. Trim excess mylar with scissors.

- (j) Subtract filter tare weight from final weight for each sample. Write the difference (mount weight) in the laboratory data book. Divide the mount weight by the corresponding carrier yield figure (written on the bismuth carrier flask) to obtain chemical yield. Enter the yield percentage in the laboratory data book.
- (k) Using the laboratory data book as a guide, begin filling out a Radiochemical Work Sheet for each sample. Enter sample number, company name, analysis (Bi-210), collection date, aliquot used, mid-elution time, and analyst's initials.
- (l) Submit finished planchettes and work sheets to the Radiochemistry Counting Room for radioassay.

#### 7.0 SAMPLE COUNTING PROCEDURES

Bismuth-210 mounts are covered with  $3 \text{ mg/cm}^2$  aluminum absorbers and are counted 200 minutes for beta activity in low level gas proportional counters. They are recounted approximately one half-life later (5 days) to check the radioactive decay.

- (a) Assign a low level gas proportional counter to each prepared bismuth mount by writing the "X counter" number in the space provided on the Radiochemical Work Sheet.
- (b) Arrange the work sheets in order according to X counter number. Take the first sheet, locate the nylon planchette bearing the indicated sample number, and load the planchette into the detector tray indicated on the sheet using a black plastic (absorber compatible) holder. Cover the mount with a No. 1 absorber ( $3 \text{ mg/cm}^2$ ).
- (c) Reset counters to zero. Set the counter timers to 200 minutes and start the counters. Write the counting start date and time on the Radiochemical Work Sheets in the spaces provided. Leave the work sheets on the tray in front of the counters.
- (d) After 200 minutes the counters will stop automatically. Write the number of counts indicated on each X counter, and the counting interval in minutes beside the corresponding X counter numbers on the Radiochemical Work Sheets. Remove the mounts from the counter trays and place them temporarily on the shelf in front of the detectors.

- (e) Proceed to calculate Bi-210 activity from the data sheet on the same day that the sample has finished counting. Retain mounts for recounting, along with their data sheets, on the shelf in front of the detectors.
- (f) After 5 days have elapsed, load the mounts into the same counters originally used, cover with a No. 1 absorber and count for 100 to 200 minutes. Record the counting date and time, and the resulting counts, on the Radiochemical Work Sheet. Remove the bismuth mounts and store in the rack provided.

## 8.0 CALCULATION OF THE SAMPLE ACTIVITY OR OF THE MDL

8.1 The equation used for calculating activity is:

$$\frac{\text{Net pCi on counting date}}{\text{gram}} = \underbrace{\frac{\frac{N}{\Delta t} - \beta}{2.22(v)(y)(DF)(\epsilon)}}_{\text{net activity}} \pm \underbrace{\frac{\sigma_m \sqrt{\frac{N + \beta}{\Delta t}}}{2.22(v)(y)(DF)(\epsilon)}}_{\text{counting error}}$$

where:

N = total counts from sample (counts)

$\Delta t_c$  = counting time for sample (min)

$\beta$  = background rate of counter (cpm)

2.22 =  $\frac{\text{dpm}}{\text{pCi}}$

v = weight of sample analyzed (grams)

y = chemical yield of the mount or sample counted

DF = decay factor of Bi-210 from the mid-elution time to the mid-count time

$\sigma_m$  = multiples of counting error

$\epsilon$  = efficiency of the counter for Bi-210 beta counting, using a No. 1 (3 mg/cm<sup>2</sup>) absorber.

8.2 Establishing and reporting activities that are equal to or less than the counting error.

- (a) If the net activity  $\left( \frac{N}{\Delta t} - \beta \right)$  is equal to or is less than the counting error, the activity on the collection date is below the limits of detection and is called "less than" (L.T.) or "minimum detectable level" (MDL).
- (b) The L.T. value can be specified by stating only the counting error at a predetermined multiple ( $\sigma m$ ) of the one sigma statistics. Implied in this is the assumption that the net activity equals the background. This method of stating the L.T. value is followed by Teledyne Isotopes. A sigma multiple ( $\sigma m$ ) of three (3) is used for calculation of the L.T. values unless otherwise indicated.

$$\text{Thus L.T.} = \frac{\sigma m \sqrt{\frac{2\beta}{\Delta t}}}{2.22(v)(y)(DF)(\epsilon)} = \frac{3 \sqrt{\frac{2\beta}{\Delta t}}}{2.22(v)(y)(DF)(\epsilon)}$$

EXHIBIT D  
NEW JERSEY  
DEPARTMENT OF ENVIRONMENTAL PROTECTION MEMORANDUM



**DRAFT**

**State of New Jersey**  
**DEPARTMENT OF ENVIRONMENTAL PROTECTION**  
**DIVISION OF HAZARDOUS SITE MITIGATION**  
401 E. State St., CN 413, Trenton, N.J. 08625  
(609) 984-2902

Anthony J. Ferro  
Director

MEMORANDUM

TO: TIEN-NYE H. VACCARI, TECHNICAL COORDINATOR, BEERA

THROUGH: DR. KATE JOYCE, ACTING ASSISTANT CHIEF, BEERA

FROM: DR. THOMAS F. MCNEVIN, RESEARCH SCIENTIST, BEERA

SUBJECT: NL INDUSTRIES RADIOLOGICAL SAMPLING OF MONITORING WELLS:  
FILTERED VS. UNFILTERED SAMPLES

As a result of our numerous discussions on the subject, along with our recent conference call with NL and EPA personnel regarding NL's desire to modify DEP's comments on their proposed sampling plan, the following recommendations are offered:

1. Monitoring well sampling should be conducted so as to minimize generation of turbidity. Optimum pump types and pumping rates should be employed. Additionally, the entire sampling operation should be monitored by the DEP project geologist, as well as a BEM field auditor.
2. Samples should be analyzed as both filtered and unfiltered on the monitoring wells for which previous radiological data exists, i.e., from the sampling episodes of December 1985 and February 1986. This will allow for the intercomparison of the two modes of sampling and will as well maintain some degree of comparability with the previously taken, unfiltered samples. Samples should preferably be field filtered. Nitric acid preservative should be added after filtration.
3. NL's scheme of filtering only those samples which contain turbidity in excess of 5 TUs, and then analyzing and reporting only the filtrate, may then be employed for the remaining monitoring wells.
4. Turbidity values should be reported for all samples, including pre- and post-filtration values.

HS132/pw

cc: John Mateo, Acting Chief, BEERA

**EXHIBIT E**



SOP NO. HW-4  
Revision #3

CLP ORGANICS DATA REVIEW  
AND PRELIMINARY REVIEW

PREPARED BY: Stelios Gerazounis DATE: 11/6/87  
Stelios Gerazounis, Chemist  
Monitoring Management Branch

CONCURRED BY: Louis Bevilacqua Date: 11/6/87  
Louis Bevilacqua  
Monitoring Management Branch

APPROVED BY: Gerard F. McKenna DATE: 11/6/87  
Gerard F. McKenna, Chief  
Monitoring Management Branch

Date: Nov. 6, 1987

Number: HW-4

Revision: 3

Title: CLP Organics Data Review

## 1.0 Introduction

- 1.1 This procedure is applicable to organics data obtained from contractor laboratories working under the Hazardous Waste Site Contract Laboratory Program (CLP).
- 1.2 The data validation is based upon analytical and quality assurance requirements specified in Solicitation, Offer and Award No. WAB5J664, revised August 1, 1985.

## 2.0 Responsibilities

### 2.1 Contractor will complete the following:

#### 2.1.1 Part I of CLP Data Assessment Checklist (Attachment 2, 3 or 4)

#### 2.1.2 Missing Data Tracking Form (Attachment 5 - heading and first two items only)

### 2.2 The Surveillance and Monitoring Branch Review (Attachment 1) will be completed by the Regional Sample Control Center (RSCC)

### 2.3 Monitoring Management Branch (MMB) data reviewers will complete Part II of the CLP Data Assessment Checklist (Attachment 2, 3, or 4) as assigned by the data review manager:

#### 2.3.1 Total Review (T) - This is a detailed inspection of all raw data and chromatograms as well as deliverables and other QC indicators (See attachment 2, CLP Data Assessment Checklist).

#### 2.3.2 Significant Element Review (SE) - Includes only those elements of Total Review within Attachment 3.

#### 2.3.3 Targeted Element Review (TE) - Entails a total review of 50% of samples of like matrix in any case, and a selective review of remaining 50% of samples for all QA/QC defects found in initial 50% review.

#### 2.3.4 Documented Risk Review (DR) - Includes only those elements of Total Review within Attachment 4. It is based on record of data rejection since 1/85, and will be updated quarterly.

### 2.4 The data review coordinator will indicate which type review is to be performed on the data review schedule posted on the bulletin board:

T - Total Review  
TE - Targeted Element Review  
SE - Significant Element Review  
DR - Documented Risk Review

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Title: CLP Organics Data Review

2.5 In addition, the reviewers will complete and/or file the following:

2.5.1 Data Review Log - Each reviewer will fill in the following information in the log book for each data package:

- a. date of start of case review
- b. date of completion of case review
- c. site
- d. case number
- e. contract laboratory
- f. number of samples
- g. matrix
- h. type review (T, TE, SE, DR)

2.5.2 Rejection Summary Form - Fill out as necessary for each category using a ratio format. The numerator would indicate the number of compounds rejected; the denominator would indicate the number of fractions containing rejected compounds. For the category titled "Total number of compounds rejected" the ratio would show a numerator indicating the total number of compounds rejected and a denominator indicating the total number of compounds analyzed for in every sample per fraction. Rejections due to field blank or trip blank contamination are listed separately from method/reagent blank contamination, and are not added to "total number of compounds rejected". File in the appropriate folder.

2.5.3 SMO Report - This form is intended for use in improving the laboratories' performance. Record all reasons for having rejected data along with any contract violations which may or may not have lead to any rejections. Make four copies. Give secretary four copies with instructions to mail to Numbers 1, 2, 3 on the SMO mailing list and to the office corresponding to the region where the lab is located. File the fifth copy in the appropriate folder.

2.5.3.1 In lieu of SMO Report, comments may be appended to end of review narrative under "Contract Violations/Problems". Do not make copies for above distribution.

2.5.4 Telephone Log - All phone conversations must be initiated by authorized laboratory contacts. If a phone call has been made, fill out stating the bare facts of the conversation. Give two copies to secretary, one to go to the laboratory and one to go to SMO. File the third copy in the appropriate folder.

2.5.5 Data Assessment Checklist - All items must be checked, except for an SE review: leave items without an asterisk blank. Conclusion page must be signed by data reviewer and by verifier (usually by DRC or DPO).

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**2.6 Forwarded Paperwork** - The following are to be forwarded to the Surveillance and Monitoring Branch (SMB) Regional Sample Control Center (RSCC) upon completion of the review:

- a. data package
- b. completed data assessment checklist (original)
- c. Parts I & II of CLP Data Assessment Checklist
- d. SMO Contract Compliance Screening (CCS)
- e. SMB Review (original)

**2.7 Filed Paperwork** - The following are to be filed within MMB files:

- a. SMB Review (Copy)
- b. Narrative part (Para. 21) of data assessment checklist (copy)
- c. SMO Report (original)
- c. Telephone Record Log (yellow copy)
- d. Rejection Summary Form (original)
- e. QC Summary (optional - only if necessary to explain review)

### 3.0 Data Completeness

Incomplete data packages must be brought to the attention of the data review coordinator (DRC) or the deputy project officer (DPO) whenever the lack of any information would cause the rejection of data.

### 4.0 Rejection of Data

All values determined to be unacceptable on the organic analysis data sheets should be lined over with a red pencil. As soon as a compound or entire sample fraction has been rejected during the review that compound or fraction can be eliminated from any further review or consideration.

### 5.0 Acceptance Criteria

In order that reviews be consistent among reviewers, acceptance criteria as stated in Attachment 3, 4 or 5 should be used. Additional guidance may be found in National SOP for data review.

### 6.0 Reviewer Corrections

All corrections to reviewed data made by reviewers must be indicated in red pencil.

### 7.0 SMO Contract Compliance Screening (CCS) and Contractor Preliminary Review

These are intended to aid reviewer in locating any problems, both corrected and uncorrected.

STANDARD OPERATING PROCEDURE

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Title: Attachment 1 - CLP Data Assessment Checklist  
(GC and GC/MS Analyses)

Date: Nov. 6, 1987  
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SURVEILLANCE AND MONITORING BRANCH REVIEW

Project Name/Site: \_\_\_\_\_

Case Number: \_\_\_\_\_

Type Investigation (Circle One): Remedial Site Other \_\_\_\_\_

Contract No.: \_\_\_\_\_

Laboratory: \_\_\_\_\_

Sample Identification Numbers:

Aqueous: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Soil/Sediment: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Superfund Account No.: \_\_\_\_\_

Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

NLI 001 0834

## STANDARD OPERATING PROCEDURE

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Date: Nov. 6, 1987

Number: HW-4

Revision: 3

Title: Attachment 2 - CLP Data Assessment Checklist (GC and  
GC/MS Analysis) - TOTAL REVIEW

## CONTRACTOR AND MONITORING MANAGEMENT BRANCH REVIEW

## PART I: Contractor and Preliminary Review

1.0 Data Completeness and Deliverables

YES NO N/A

1.1 Are any deliverables missing? ☐ ☐ ☐1.2 Was SMO CCS checklist included with package? ☐ ☐ ☐

CONTRACTOR ACTION: If incomplete, list any missing data  
on the Missing Data Tracking Form  
(Attachment 5), and request missing  
information from laboratory by phone.

I. COVER LETTER/NARRATIVE2.0 Cover Letter/Case Narrative2.1 Is the Narrative or Cover Letter present? ☐ ☐ ☐2.2 Are the following items contained in the Narrative  
or Cover Letter:a. Case Number and/or SAS Number ☐ ☐ ☐b. Contract Number ☐ ☐ ☐II. QC SUMMARY

## 3.0 Surrogate Percent Recovery Summaries (Form II)

3.1 Are the Surrogate Percent Recovery Summaries present  
for each of the following matrix:a. Water ☐ ☐ ☐b. Soil ☐ ☐ ☐3.2 Are all the samples listed on the Surrogate Percent  
Recovery Summaries for each of the following matrix:a. Water ☐ ☐ ☐b. Soil ☐ ☐ ☐

NLI 001 0835

Title: Attachment 1 - CLP Data Assessment Checklist  
(GC and GC/MS Analysis) Part I:  
Contractor and Preliminary Review  
TOTAL REVIEW

Date: Nov. 6, 1987  
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	YES	NO	N/A
3.3 Were outliers marked correctly with an asterisk?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

CONTRACTOR ACTION: Circle all outliers in red.

3.4 Were two or more BN surrogates outside of contract specifications (or one surrogate less than 10% recovery) for any samples?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
----------------------------------------------------------------------------------------------------------------------------------	--------------------------	--------------------------	--------------------------

Method Blanks?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------	--------------------------

If yes, were samples reanalyzed?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------	--------------------------

Were method blanks reanalyzed?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------	--------------------------

**MMB ACTION:** If initial analysis and reanalysis both have 2 or more surrogate recoveries less than contract QC requirements (or one surrogate less than 10%) red-line all the detection limits (u's) and flag all positive data (hits) with a J.

If initial analysis and reanalysis both have two or more surrogate recoveries above contract QC requirements do not red-line detection limits (u's) but flag all positive values with a J.

When two or more surrogates for the blank are below contract QC requirements red-line all positive values, but not detection limits, for the associated samples, if sample surrogates are within or above QC limits; but if two or more sample surrogates are below contract QC limits, red-lined all sample data (Detection limits and positive data).

When two or more surrogates for the blank exceed contract QC requirements, validate sample data considering sample surrogate recoveries alone.

3.5 Were two or more acid surrogates outside of contract specifications (or one surrogate less than 10% recovery) for any samples?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
------------------------------------------------------------------------------------------------------------------------------------	--------------------------	--------------------------	--------------------------

Method Blanks?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------	--------------------------

If yes, were samples reanalyzed?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------	--------------------------

Were method blanks reanalyzed?

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
--------------------------	--------------------------	--------------------------

**MMB ACTION:** If initial analysis and reanalysis both have 2 or more surrogate recoveries less than contract QC requirements (or one surrogate less than 10%) red-line all the detection limits (u's) and flag all positive data (hits) with a J.

If initial analysis and reanalysis both have two or more surrogate recoveries above contract QC requirements do not red-line detection limits (u's) but flag all positive values with a J.

Title: Attachment 1 - CLP Data Assessment Checklist  
(GC and GC/MS Analysis) Part I:  
Contractor and Preliminary Review  
TOTAL REVIEW

Date: Nov. 6, 1987  
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When two or more surrogates for the blank are below contract QC requirements red-line all positive values, but not detection limits, for the associated samples, if sample surrogates are within or above QC limits; but if two or more sample surrogates are below contract QC limits, red-lined all sample data (Detection limits and positive data).

When two or more surrogates for the blank exceed contract QC requirements, validate sample data considering sample surrogate recoveries alone.

	<u>YES</u>	<u>NO</u>	<u>N/A</u>
3.6 Was one or more VOA surrogates outside of contract specifications for any samples?	___	<input type="checkbox"/>	___
Method Blanks?	___	<input type="checkbox"/>	___
If yes, were samples reanalyzed?	<input type="checkbox"/>	___	___
Were method blanks reanalyzed?	<input type="checkbox"/>	___	___

MMB ACTION: If initial analysis and reanalysis both have one or more surrogate recoveries below contract QC requirements red-line all detection limits (u's) and flag all positive values (hits) with a J.

If initial analysis and reanalysis both have one or more surrogate recoveries above contract QC requirements do not red-line detection limits but flag all positive values with a J.

When one or more surrogate recoveries for the blank are below contract QC requirements red-line all positive values but not the detection limits for the associated samples if sample surrogates are within or above contract QC limits; but if one or more sample surrogate recoveries are below QC limits red-line all data (Detection limits and positive values).

When one or more surrogate recoveries for the blank exceed contract requirement validate data for the associated samples considering sample surrogate recoveries alone.

3.7 Was pesticides/PCB surrogate outside of contract specifications for any samples?	___	<input type="checkbox"/>	___
Blanks?	___	<input type="checkbox"/>	___

MMB ACTION: If recoveries are below contract requirement flag all associated positive results with a J and red-line all detection limits. If the recoveries are above contract requirement do not red-line the detection limits but flag all positive value with a J. However professional judgement should be used to determine whether a high bias exists due to coeluting interferences.



Title: Attachment 1 - CLP Data Assessment Checklist  
(GC and GC/MS Analysis) Part I:  
Contractor and Preliminary Review  
TOTAL REVIEW

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#### 4.0 Matrix Spikes

YES      NO      N/A

4.1 Is the Matrix Spike Duplicate/Recovery Form Present  
(Form III)?

[ ]      —      —

4.2 Were matrix spikes analyzed at the required frequency  
for:

[ ]      —      —

Water?

[ ]      —      —

Soil/Sediment?

[ ]      —      —

4.2.1 For each set in a case or for every 20 samples of similar  
matrix is one sample spiked in duplicate?

[ ]      —      —

#### 4.3 Form III

4.3.1 How many spikes are outside of recovery limits?

	<u>Water</u>	<u>Soils</u>
VOA's?	<u>: out of 10</u>	<u>; out of 10</u>
B/N?	<u>: out of 12</u>	<u>; out of 12</u>
Acids?	<u>: out of 10</u>	<u>; out of 10</u>
Pesticides?	<u>: out of 12</u>	<u>; out of 12</u>

4.3.2 How many RPD's for matrix spike and matrix spike  
duplicates are outside of accepted limits?

	<u>Water</u>	<u>Soils</u>
VOA's?	<u>: out of 5</u>	<u>; out of 5</u>
B/N?	<u>: out of 6</u>	<u>; out of 6</u>
Acids?	<u>: out of 5</u>	<u>; out of 5</u>
Pesticides?	<u>: out of 6</u>	<u>; out of 6</u>

MMB ACTION: Use results only in conjunction with  
other QC criteria in determining the  
acceptability of reported data.

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YES      NO      N/A

[ ]

[ ]

11.

B/N/A's  
Pesticides/PCB's

H - -

[ ]

6.1. Do any method/instrument/reagent blanks have positive results (HSL and/or TIC) for: VOA's?

**VOA's?**

[ ]

**B/N?**

[ ]

**Acids?**

[ ]

## Pesticides?

[ ]

**PCBs?**

[ ]

6.2 Do any field/trip blanks have positive results (HSL and or TIC) for: VOA's?

VOA'S?

[ ]

**B/N?**

( )

### Acids?

[ ]

## Pesticides?

[ ]

PCBs?

( )

Title: Attachment 1 - CLP Data Assessment Checklist  
(GC and GC/MS Analysis) Part I:  
Contractor and Preliminary Review  
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CONTRACTOR ACTION: Prepare a list of the samples associated with each of the contaminated and/or missing method blanks (attach a separate sheet).

YES NO N/A

MMB ACTION: For common blank contaminants found (e.g., methylene chloride, acetone, toluene, 2-butanone, and phthalate esters) reject (red-line) all associated positive results present at less than 10 times the blank contaminant levels; for all other contaminants reject (red-line) when all associated positive results are present at less than 5 times the blank contaminant levels. Do not reject any values reported with a "U" (detection limit values). The concentration of contaminants in the VOA blank must be multiplied by the sample dilution factor prior to applying the above rejection criteria.

#### 7.0 GC/MS Tuning and Mass Calibration Forms (Form V)

7.1 Are the GC/MS Tuning and Mass Calibration forms present for the following:

7.1.1 Bromofluorobenzene (BFB) ☐ ☐ ☐

7.1.2 Decafluorotriphenylphosphine (DFTPP) ☐ ☐ ☐

CONTRACTOR ACTION: List any missing GC/MS Tuning and Mass Calibration Form on the Missing Data Tracking Form. (See 1.1)

#### 7.2 GC/MS Tuning Criteria

7.2.1 Has a tuning performance compound been run for every 12 hours of sample analysis per instrument? ☐ ☐ ☐

CONTRACTOR ACTION: If no, list date, time, instrument ID, fraction and samples run with no associated GC/MS tuning.

DATE	TIME	INSTRUMENT	FRACTION	SAMPLE NUMBERS

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	<u>YES</u>	<u>NO</u>	<u>N/A</u>
MMB ACTION: If no, reject (red-line) all associated data for that instrument which fall outside an acceptable 12 hour time interval.			
7.2.2 Have the expanded ion abundance criteria been met for each instrument used?	<input type="checkbox"/>	___	___
CONTRACTOR ACTION: Circle all data which do not meet expanded ion abundance criteria in red.			
MMB ACTION: If there is an error in mass calibration or if expanded ion abundance criteria are not met, reject (red-line) all associated data.			
7.2.3 Are the enhanced bar graph spectrum and mass/charge (m/z) listings (QC Data Package Section 5) for the BFB provided for each twelve (12) hour shift?	<input type="checkbox"/>	___	___
CONTRACTOR ACTION: If no, please list the missing spectrum and listings on Missing Data Tracking Form.			
7.2.4 Are the enhanced bar graph spectrum and mass/charge (m/z) listings (QC Data Package Section 5) for the DFTPP provided for each twelve (12) hour shift?	<input type="checkbox"/>	___	___
CONTRACTOR ACTION: If no, please list the missing spectrum and listings on Missing Data Tracking Form.			
7.2.5 Are there any transcription errors in going from mass lists to the GC/MS Tuning and Calibration forms? (Check at least 2 values but if errors are found check more values.)	___	<input type="checkbox"/>	___
7.2.6 Have the appropriate number of significant figures (3) been reported? (Check at least 2 values, but if errors are found check more values.)	<input type="checkbox"/>	___	___
CONTRACTOR ACTION: If no, make necessary corrections in red pencil and initial.			

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YES      NO      N/A

7.2.7 Are there any calculation errors in the tuning ratios? (For example, the ratios of M/Z 199/198 and 443/442 for DFTPP.) (Check at least 2 values.)

BFB (VOAs)?

DFTPP (NVOAs)?

CONTRACTOR ACTION: Recalculate, make necessary corrections in red pencil and initial.

8.0 Is the Cross Reference Table present?

### III SAMPLE DATA

9.0 Are the Traffic Report Forms present for all samples?

CONTRACTOR ACTION: List missing Traffic Reports on Missing Data Tracking Form. (See 1.1)

### 10.0 Organic Analysis Data

10.1 Are the four (4) Organic Analysis Data Sheets (Form I for VOA, BNA, Pesticides and Tentatively Identified Compounds) with completed header information required on each page present for each of the following:

a. Samples and/or fractions as appropriate

b. Matrix spikes and matrix spike duplicates

c. Blanks

CONTRACTOR ACTION: List Missing or incomplete Data Sheets on missing Data Tracking Form. (See 1.1)

10.2 Are the VOA/BNA Reconstructed Ion Chromatograms for each sample, the mass spectra for the identified compounds, and the Data System Printouts (Quant. list) included in the sample package for each of the following?

a. Samples and/or fractions as appropriate

b. Matrix spikes and matrix spike duplicates  
(Mass spectra not required)

c. Blanks

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	<u>YES</u>	<u>NO</u>	<u>N/A</u>
10.3 Are the response factors shown in the Quant Lists?	<input type="checkbox"/>	___	___

CONTRACTOR ACTION: List Missing or incomplete Reconstructed Ion Chromatograms, mass spectra and Data System printouts on the Missing Data Tracking Form (See 1.1).

10.4 Are the Tentatively Identified Compounds (Form I, Part B) present and include scan number and estimated concentration?	<input type="checkbox"/>	___	___
-----------------------------------------------------------------------------------------------------------------------------	--------------------------	-----	-----

CONTRACTOR ACTION: List missing TICs, Form I on Missing Data Tracking Form (See 1.1).

10.5 Are the lab generated <u>standard</u> mass spectra of the identified compounds for each sample present?			
--------------------------------------------------------------------------------------------------------------	--	--	--

a. Volatile standard spectra	<input type="checkbox"/>	___	___
------------------------------	--------------------------	-----	-----

b. Semi-volatile standard spectra	<input type="checkbox"/>	___	___
-----------------------------------	--------------------------	-----	-----

CONTRACTOR ACTION: List missing mass spectra on Missing Data Tracking Form (See 1.1).

#### 11.0 GC/MS Evaluation

11.1 Are the mass spectra for the tentatively identified compounds and associated "best match" spectra included in the sample package for each of the following.

a. Samples and/or fractions as appropriate	<input type="checkbox"/>	___	___
--------------------------------------------	--------------------------	-----	-----

b. Blanks	<input type="checkbox"/>	___	___
-----------	--------------------------	-----	-----

CONTRACTOR ACTION: If no, list the missing numbers on the Missing Data Tracking Form (See 1.1)

#### 12.0 Holding Times

12.1 Have any holding times from date of collection been exceeded for:

a. Volatiles

Aqueous: 10 days\* from time the lab receives the sample with 24 hours allowed from time of collection to lab receipt.

___	<input type="checkbox"/>	___
-----	--------------------------	-----

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	<u>YES</u>	<u>NO</u>	<u>N/A</u>
Soil/Sediment: 10 days from time the lab receives the sample with 24 hours allowed from time of collection to lab receipt.	___	[___]	___
b. NVOA's and Pesticides/PCBs:			
Aqueous (5 days from time of lab receipt to extraction, 40 days after extraction)	___	[___]	___
Soil/Sediment (10 days from time of lab receipt to extraction, 40 days after extraction)	___	[___]	___
Allow 24 hours from time of collection to lab receipt.			
CONTRACTOR ACTION: List the samples and their respective fractions with exceedances below. (Attach additional sheets if necessary.)			

Table of Holding Time Exceedances

<u>Sample</u>	<u>Sample Matrix</u>	<u>Fraction(s)</u>	<u>(See Traffic Report)</u>		<u>(See Form I)</u>	<u>(See Form I &amp; Form V)</u>
			<u>Date Sampled</u>	<u>Date Lab Received</u>	<u>Date Extracted</u>	<u>Date Analyzed</u>
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____

MMB ACTION: If these holding times are exceeded, red-line detection limits and flag all positive values with a J.

13.0 Standards Data (GC/MS)

13.1 Are the Reconstructed Ion Chromatograms, Data System Printouts (Quant. list), and work sheet calculations present for the following:

a. Semi-volatiles (initial and continuing calibrations)

[\_\_\_] \_\_\_

b. Volatiles (initial and continuing calibrations)

[\_\_\_] \_\_\_

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	<u>YES</u>	<u>NO</u>	<u>N/A</u>
13.2 Are the response factors also present in the Quan List?	<input type="checkbox"/>	___	___
CONTRACTOR ACTION: List missing or incomplete RICs, Quant. lists and work sheet calculations on Missing Data Tracking Form (See 1.1).			
14.0 <u>GC/MS Initial Calibration Data Sheets (Form VI)</u>			
14.1 Are the Initial Calibration Data Sheets present and completely filled out for all compounds for the following fractions:			
a. Semi-volatiles	<input type="checkbox"/>	___	___
b. Volatiles	<input type="checkbox"/>	___	___
CONTRACTOR ACTION: List missing RICs, Quant. lists and work sheet calculations on Missing Data Tracking Form.			
14.2 <u>RF Stability - Form VI</u>			
14.2.1 Are response factors stable for non-CCC compounds over the concentration range of the calibration (RSD for non-CCC compounds <50%) for:			
VOA's?	<input type="checkbox"/>	___	___
B/N?	<input type="checkbox"/>	___	___
Acids?	<input type="checkbox"/>	___	___
CONTRACTOR ACTION: Circle all outliers in red.			
MMB Action: For the non-CCC compounds when RSD >50% red-line the u value(s) or flag positive value(s) with a J for the associated compound(s) only.			
14.2.2 Do any non-SPCC compounds have an average response factor equal to or near zero (<0.025)?			
VOA's?	___	<input type="checkbox"/>	___
B/N?	___	<input type="checkbox"/>	___
Acids?	___	<input type="checkbox"/>	___
CONTRACTOR ACTION: Circle all outliers in red.			



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YES      NO      N/A

MMB ACTION: For the outlier(s) reject (red-line)  
u values or flag with a J positive  
data for the associated compound(s).

14.3 Transcriptions and Calculations

14.3.1 Are any transcriptions/calculation errors found in  
the reporting of average response factors (RF)  
for SPCC's? (Check at least 2 but if errors are  
found check more values.)

\_\_\_ [ ] \_\_\_

14.3.2 Are any transcription/calculation errors found in  
the reporting of percent RSD for CCC's? (Check 2  
but if errors are found check more values.)

\_\_\_ [ ] \_\_\_

CONTRACTOR ACTION: Circle errors in red and enter  
corrected values.

MMB ACTION: If any changes in 14.2.1 and 14.2.2  
are made, see MMB ACTION under 14.3.2.

14.4 Check Compounds - (SPCC and CCC) (Form VI)

14.4.1 How many SPCC's have an average response factor less than:

Number of      Instrument  
Outliers      ID/Date

0.300 VOAs, except 0.250 for bromoform

\_\_\_\_\_

0.05 Base/Neutrals

\_\_\_\_\_

0.05 Acids

\_\_\_\_\_

Number of      Instrument  
Outliers      ID/Date

14.4.2 How many CCCs have greater than 30% RSD for response factors:

VOAs?

\_\_\_\_\_

Base/Neutrals?

\_\_\_\_\_

Acids?

\_\_\_\_\_

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MMB ACTION: For the volatile fraction, if the combined total of CCC's and SPCC's outside the acceptance limits is 5 or greater, reject all u values for the entire fraction of all samples run and flag with a J all positive values. For the acid fraction, the above applies with a combined total of 3 or greater SPCC's and CCC's. For the base/neutral fraction, the above applies with a combined total of 5 SPCC's and CCC's. If there are not enough compounds outside of acceptance to reject entire fractions, then reject or flag with a J those individual compounds for samples run within 12 hours of the calibration which have either CCC or SPCC values out of acceptance.

#### 15.0 GC/MS Continuing Calibration

##### 15.1 Calibration Check Sheets (Form VII)

15.1.1 Are the Calibration Check Sheets present and completely filled out for all compounds for the following fractions:

YES      NO      N/A

a. semi-volatiles

☐      ☐      ☐

b. volatiles

☐      ☐      ☐

CONTRACTOR ACTION: List missing calibration check sheets on Missing Data Tracking Form (See 1.1).

15.2 Has a continuing calibration been run for every 12 hours of sample analysis per instrument?

☐      ☐      ☐

CONTRACTOR ACTION: List below all samples which do not have a continuing calibration within 12 hours.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

MMB ACTION: If no (for either initial or continuing), reject (red-line) all corresponding sample data.

15.3 Form VII: Check Compounds (SPCC & CCC) Form VII - System Performance Calibration Compounds (SPCC) and Calibration Check Compounds (CCC)

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15.3.1 How many SPCC's have an average response factor less than:

0.300 VOAs, except 0.250 for bromoform

0.05 Base/Neutrals

0.05 Acids

<u>Number of</u> <u>Outliers</u>	<u>Instrument</u> <u>ID/Date</u>
-------------------------------------	-------------------------------------

_____	_____
-------	-------

_____	_____
-------	-------

_____	_____
-------	-------

15.3.2 How many CCC's have a greater than 25% D for response factors:

VOAs?

Base/Neutrals?

Acids?

<u>Number of</u> <u>Outliers</u>	<u>Instrument</u> <u>ID/Date</u>
-------------------------------------	-------------------------------------

_____	_____
-------	-------

_____	_____
-------	-------

_____	_____
-------	-------

CONTRACTOR ACTION: Circle all outliers in red. List below the dates of continuing calibrations with outliers, and the associated samples.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

MMB ACTION: For the volatile fraction, if the combined total of CCC's and SPCC's outside the acceptance limits is 5 or greater, reject all u values for the entire fraction of all samples run and flag all positive data with a J. For the acid fraction, the above applies with a combined total of 3 or greater SPCC's and CCC's. For the base/neutral fraction, the above applies with a combined total of 5 SPCC's and CCC's. If there are not enough compounds outside of acceptance to reject entire fractions, then reject or flag with a J those individual compounds for samples run within 12 hours of the calibration which have either CCC or SPCC values out of acceptance.

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15.3.3 Are any transcription/calculation errors found in reporting XD values between initial calibration RFs and continuing calibration RFs? (Check at least 2 but if errors are found check more values).

YES NO N/A

— [ ] —

CONTRACTOR ACTION: Circle errors in red and make any necessary corrections.

MMB ACTION: Check any necessary corrections and if any changes were made, see ACTION under section 15.3.2.

15.4 Internal Standard Area Summary (Form VIII)

15.4.1 Are the internal standard summary sheets (Form VIII) present and complete with all the required information?

VOA [ ] — —

BNA [ ] — —

CONTRACTOR: List missing or incomplete summary sheets on missing tracking form (see 1.1).

15.4.2 Are the internal standard areas within the upper and lower limits for each sample and blank analyzed under a given continuing calibration?

VOA [ ] — —

BNA [ ] — —

CONTRACTOR: List all the outliers.

<u>Sample #</u>	<u>Internal Std</u>	<u>Area</u>	<u>Lower Limit</u>	<u>Upper Limit</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

(Attach additional sheets if necessary.)

MMB ACTION: Use professional judgement to determine effect on data. Acceptance or rejection should not be based solely on the internal standard areas but should be determined in conjunction with other QA/QC data.

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	<u>YES</u>	<u>NO</u>	<u>N/A</u>
<b>16.0 Pesticide Data Package (Forms VIII, IX, and X)</b>			
16.1 Is the Pesticide Evaluation Check for Linearity Summary (Form VIII) present?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16.2 Is the Evaluation Check for 4 4' DDT/Endrin breakdown present (Form VIII)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16.3 Is the pesticide/PCB standards summary (Form IX) present?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16.4 Is the pesticide/PCB identification summary (Form X) present?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16.5 Are the following Gas Chromatograms and Data System Printouts for both Primary and Confirmation columns present?			
a. Evaluation Standard Mix A	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Evaluation Standard Mix B	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Evaluation Standard Mix C	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Individual Standard Mix A	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. Individual Standard Mix B	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. Multi-component Pesticides Toxaphene Chlordane	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g. Aroclors 1016/1260	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h. Aroclors 1221, 1232, 1242, 1248 and 1254	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16.6 Are the Gas Chromatograms and Data System for both primary and confirmation columns if required present?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

CONTRACTOR ACTION: For all missing forms, chromatograms data system printouts and confirmation column data list on the Missing Data Tracking Form (See 1.1).

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YES      NO      N/A

17.0 GC Performance and Calibration

- 17.1 DDT Retention Time check - Is DDT retention time on packed columns greater than or equal to 12 minutes? (Form IX-PEST)

[ ]      —      —

CONTRACTOR ACTION: If DDT retention times on packed columns is <12 minutes circle in red.

17.2 Analytical Sequence - Form VIII

- 17.2.1 Have all standards been run within required time frames? (Quantitation and Confirmation column runs)

[ ]      —      —

MMB ACTION: If no, use professional judgment to determine severity of effects on data, and accept or reject the data accordingly.

- 17.2.2 Has the proper sequence of standards and samples been followed. (p. PEST D-36, Section 6.1.3.5)

[ ]      —      —

MMB ACTION: If no, use professional judgment to determine severity of effects on data, and accept or reject the data accordingly.

- 17.3 DDT/Endrin Degradation Check (Form VIII, PEST-1) - Has the total percent breakdown for DDT/Endrin exceeded 20%?

—      [ ]      —

CONTRACTOR ACTION: Circle all outliers in red.

MMB ACTION:

- 1) If DDT breakdown is greater than 20%:

- a. all positive results for DDT shall be flagged with a J;
- b. qualitative and quantitative results for DDD and DDE shall be rejected; and,
- c. all other pesticides/PCB results should be inspected closely for acceptability.

- 2) If endrin breakdown is greater than 20%:

- a. all positive results for endrin shall be flagged with a J;

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YES NO N/A

b. qualitative and quantitative results for endrin aldehyde and endrin ketone should be rejected; and,

c. all other results should be inspected closely for acceptability.

17.4 DBC Retention Time Check - Is percent difference between each analysis and Initial Evaluation Check (Form VIII, PEST 2) less than 2% for packed columns, and less than 0.3% for capillary columns and less than 1% for megabore capillary columns.

☐              

CLP ACTION: List samples with outliers below:

<u>DATE</u>	<u>TIME OF RUN</u>	<u>SAMPLE NUMBERS</u>
<u>          </u>	<u>          </u>	<u>          </u>
<u>          </u>	<u>          </u>	<u>          </u>
<u>          </u>	<u>          </u>	<u>          </u>
<u>          </u>	<u>          </u>	<u>          </u>

MMB ACTION: If no, corresponding sample fractions should be rejected (red-lined). NOTE: the absence of a DBC peak does not constitute a violation of the above condition, since DBC may be absent due to low recovery or dilution. If DBC peak is absent use professional judgment to determine acceptability of data.

#### 17.5 Initial Calibration

17.5.1 Linearity Check - Is the % RSD of calibration factors (Form VIII) less than 10% (on the quantitation column) for each 72 hour period for:

Aldrin?	<input type="checkbox"/>	<u>      </u>	<u>      </u>
Eldrin?	<input type="checkbox"/>	<u>      </u>	<u>      </u>
DDT?	<input type="checkbox"/>	<u>      </u>	<u>      </u>
Dibutylchlorodate?	<input type="checkbox"/>	<u>      </u>	<u>      </u>

CONTRACTOR ACTION: Circle all outliers in red.

MMB ACTION: If no, all associated positive results should be flagged with a J.

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YES NO N/A

## 17.6 Continuing Calibration (Form IX-PEST).

17.6.1 Are the alternating standards' calibration factors within 15% of calibration factors for Ind. A & B at the beginning of the 72 hour period (20% for both of above for non-quantitation mix)?

Quantitation Mix

☐☐☐

Non-Quantitative Mix

☐☐☐

17.6.2 If no, were analyses repeated as required by contract?

☐☐☐

17.6.3 Were repeats within contract limits?

☐☐☐

CONTRACTOR ACTION: Circle all outliers in red.

MMB ACTION: If quantitation standards were outside of contract limits, flag with a J all associated positive results. If non-quantitation standards were outside of contract limits, use professional judgment to determine acceptability of data.

18.0 GC Evaluation (Form X-PEST)

18.1 Pesticide/PCB Identification - Are retention times of standard and sample compounds within the calculated retention time windows for the:

Quantitation Column?

☐☐☐

Confirmation Column?

☐☐☐

CONTRACTOR ACTION: Circle all outliers in red.

19.0 Package Copies

19.1 Are all the xeroxing of readable quality?

☐☐☐

CONTRACTOR ACTION: If not, list appropriate page numbers on Missing Data Tracking Form (See 1.1).

CONTRACTOR PREPARER \_\_\_\_\_

COMPLETION DATE \_\_\_\_\_

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(GC and GC/MS Analysis)  
PART II: MMB Review - TOTAL REVIEW

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YES      NO      N/A

### 1.0 Data Completeness and Deliverables

- 1.1 Have all the missing deliverables been received and added to the data package.

[ ]      —      —

MMB ACTION: Note any missing data and its effect on reviewing the package under conclusions section contract problems/non-compliance.

### I CASE NARRATIVE

#### 2.0 Cover Letter/Case Narrative

- 2.1 Are the Case Number and/or SAS Number, Contract Number and Superfund Account Number correct?

[ ]      —      —

### II QC SUMMARY RESULTS

#### 3.0 Surrogate Spikes

- 3.1 Were any transcription/calculation errors found between raw data and Surrogate Per Cent Recovery Form?

—      [ ]      —

MMB ACTION: Make any necessary corrections, and note errors under Conclusions.

- 3.2 Were the appropriate actions designated MMB ACTION Paragraph 3 in Part I taken?

[ ]      —      —

#### 4.0 Matrix Spikes

- 4.1 Was Matrix Spike data used in conjunction with other QC criteria in determining the acceptability of reported data?

[ ]      —      —

#### 5.0 Blanks

- 5.1 Chromatography - review the blank raw data - chromatograms, RICs, quan reports or data system printouts and spectra. Is chromatographic performance for each instrument acceptable for:

VOA's? [ ]      —      —

B/N & Acids? [ ]      —      —

Pest/PCB's? [ ]      —      —

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	<u>YES</u>	<u>NO</u>	<u>N/A</u>
<b>6.0 <u>GC/MS Tuning and Mass Calibration</u></b>			
6.1 Are the spectra of the mass calibration compounds acceptable?	<input type="checkbox"/>	___	___
MMB ACTION: Use professional judgment to determine whether associated data should be accepted, qualified, or rejected.			
<b>7.0 <u>Cross Reference Table</u></b>			
7.1 If a cross-reference table is missing, are the sample runs clearly labeled and not confusing to the reviewer?	<input type="checkbox"/>	___	___
<b><u>III SAMPLE DATA PACKAGE</u></b>			
<b>8.0 <u>Traffic Report</u></b>			
8.1 Do the Traffic Reports indicate any problems with sample receipt, condition of samples or special notations affecting the quality of the data?	___	<input type="checkbox"/>	___
MMB ACTION: Use professional judgment in evaluating any effect on the quality of the data.			
<b>9.0 <u>Organic Analysis Data</u></b>			
<b>9.1 <u>Compound ID - Qualitative Requirements</u></b>			
<b>19.1.1 Chromatography - Is chromatography performance acceptable for the following?</b>			
Baseline stability	<input type="checkbox"/>	___	___
Resolution	<input type="checkbox"/>	___	___
Peak shape	<input type="checkbox"/>	___	___
Full-scale setting (attenuation)	<input type="checkbox"/>	___	___
Other: _____	<input type="checkbox"/>	___	___
MMB ACTION: Use professional judgment to determine the acceptability of the data.			

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Title: Attachment 1 - CLP Data Assessment Checklist  
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YES      NO      N/A

10.0 GC/MS Evaluation10.1 HSL Compounds

10.1.1 Is the RRT of reported compounds within 0.06 RRT units of the standard RRT?

☐      ☐      ☐

10.1.2 Are all ions present in the standard mass spectrum at a relative intensity greater than 10% also present in the sample mass spectrum?

☐      ☐      ☐

10.1.3 Are all ions present in the sample, but not present in the standard accounted for?

☐      ☐      ☐

10.1.4 Do relative intensities specified above agree within 20% between the sample and standard spectra?

☐      ☐      ☐

MMB ACTION: Use professional judgment to determine acceptability of data: if it is determined that incorrect ID's were made, all such data should be red-lined and changed to the calculated detection limits. Ions greater than 10% in the sample spectrum but not present in the standard spectrum must be considered and accounted for.

10.1.5 Check at least 2 of all positive values. Were any errors found in:

Transcriptions?

☐      ☐      ☐

Calculations?

☐      ☐      ☐

MMB ACTION: Make any necessary corrections and note errors under Conclusions.

10.2 Tentative ID - Non-HSL Compounds

10.2.1 Are all ions present in the reference mass spectrum with a relative intensity greater than 10% present in the sample mass spectrum?

☐      ☐      ☐

10.2.2 Do relative intensities specified above agree within 20% between the sample and reference spectra?

☐      ☐      ☐

10.2.3 Are molecular ions present in reference spectrum present in sample spectrum?

☐      ☐      ☐

NLI 001 0856

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Title: Attachment 1 - CLP Data Assessment Checklist  
(GC and GC/MS Analysis)  
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- 10.2.4 Are all non-HSL compounds classified as tentatively identified reported with estimated quantitation and detection limits?

YES      NO      N/A

[ ]      —      —

MMB ACTION: Use professional judgment to determine acceptability of data. If data is considered to be unacceptable, the tentative ID should be changed to "unknown".

#### 11.0 Holding Times

- 11.1 Have all associated sample data which have exceeded holding times been red-lined on the data sheet (including detection limits) indicating rejection?

[ ]      —      —

MMB ACTION: Make any necessary corrections.

#### 12.0 GC Evaluation

- 12.1 Do chromatograms and data system printouts confirm retention times, retention time windows, and reported values (Forms IX-PEST 1 and X-PEST 2)?

[ ]      —      —

- 12.2 Do positive identifications have proper dissimilar column analysis?

[ ]      —      —

- 12.3 Are retention times of standard and sample compounds within the calculated retention times windows for the:

Quantitation Column? [ ]      —      —

Confirmation Column? [ ]      —      —

- 12.4 If concentration is sufficient (>10 ug/ml in the extract), is GC/GS confirmation provided?

[ ]      —      —

MMB ACTION: Reject (red-line) all positive results (meeting quantitation column criteria, but missing confirmation by a second column or GC/MS (if appropriate). Also reject (red-line) all positive results not meeting retention time window criteria unless associated standard compounds are similarly biased.

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	<u>YES</u>	<u>NO</u>	<u>N/A</u>
12.5 Check 10% of all positive values. Were any errors found in:			
Transcriptions?	___	[___]	___
Calculations?	___	[___]	___
MMB ACTION: Make any necessary corrections and note errors under Conclusions.			
<u>13.0 GC/MS Standards Data</u>			
13.1 Have all missing standards data been added to the package?	[___]	___	___
MMB ACTION: Same as for Sec. 1.1, Part II.			
<u>14.0 GC/MS Initial Calibration</u>			
14.1 If initial calibration raw data is provided, is chromatographic performance acceptable for each instrument?	[___]	___	___
MMB ACTION: List exceptions under Conclusions. Use professional judgment to determine effect on data. Acceptance or rejection should not be based solely on this factor, but should be determined in conjunction with other criteria.			
<u>15.0 Transcription and Calculation</u>			
15.1 Are any transcription/calculation errors found in the reporting of response factors (RF) for SPCCs? Check at least 2 but if errors are found check more values.	___	[___]	___
MMB ACTION: Make any necessary corrections. If changes were made, use professional judgment to determine effect on data.			
<u>15.2 Check Compounds - (SPCC and CCC)</u>			
15.2.1 Have all associated sample data which have exceeded the combined SPCC and CCC's (see MMB Action Section 14.3 Part I) been red-lined or flagged on the data sheet indicating rejection or an estimated value?	[___]	___	___
MMB ACTION: If no, make any necessary corrections.			

NLI 001 0858

Title: Attachment 1 - CLP Data Assessment Checklist  
(GC and GC/MS Analysis)  
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### 16.0 GC/MS Continuing Calibration

YES NO N/A

- 16.1 Were any analytes rejected due to exceedances of Continuing Calibration criteria (See Sec. 15 of Part I)?

\_\_\_ [ ] \_\_\_

MMB ACTION: Check Form I's to assure rejected data has been red-lined, and check data assessment narrative (Sec. 19.1) for appropriate comments. Make any necessary corrections.

### 17.0 Pesticide Data Package

- 17.1 Have all missing pesticide data forms been added to the package?

[ ] \_\_\_

MMB ACTION: Same as for Sec. 1.1, Part II.

### 18.0 GC Performance and Calibration - Pesticides/PCBs

- 18.1 DDT Retention Time Check - Is DDT retention time on packed columns greater than or equal to 12 minutes?

[ ] \_\_\_

If no on Contractor checklist, check compound separation. Is adequate separation achieved?

[ ] \_\_\_

MMB ACTION: If adequate separation is not achieved reject (red-line) all affected compound data.

- 18.2 Retention Time Windows - Have retention time windows been properly determined and documented for each compound?

[ ] \_\_\_

MMB ACTION: Recalculate if errors are found, and note errors under Conclusions. If documentation is missing, notify DRC or DPO.

- 18.3 Do chromatograms and printouts verify data as reported on the Pesticide Evaluation Standards Summary (Form VIII)?

[ ] \_\_\_

- 18.4 Were calibration factors calculated and transposed correctly (check at least 2 calibration factors; but if errors are found check more)?

[ ] \_\_\_

MMB ACTION: Make any necessary corrections and reapply criteria in Part I, section 17.6. Note errors under Conclusions.

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Title: Attachment 2 - CLP Data Assessment Checklist  
(GC and GC/MS Analysis)

PART II: MMB Review - TOTAL REVIEW

CASE # \_\_\_\_\_ LAB \_\_\_\_\_ SITE \_\_\_\_\_

19.0 Conclusions: (NOTE: Reviewers must red-line unacceptable data on sample data (FORM I) sheets; red-line data does not imply the compound is not present). Only the MMB reviewer has the authority to red-line unacceptable data. The letter J indicates an estimated value. In addition to the two definitions stated in the contract it also implies that the analyte is present but the quantitative value contains an unspecified degree of error. If an accurate quantity is desired, resampling/analysis is recommended.

19.1 Data Assessment \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
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\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_19.2 Contract Problems/Non-compliance \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Reviewer's Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Verified By: \_\_\_\_\_ Date: \_\_\_\_\_

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CLP Laboratory: \_\_\_\_\_ Preliminary Reviewer: \_\_\_\_\_

[illegible]



EXHIBIT F

SOP NO. HW-2

Evaluation of Inorganic Data for the Contract Laboratory Program (CLP)

based on

Solicitation, Offer and Award No. WA84J091 (SOW 785)

September 3, 1986

Revision V

PREPARED BY:

John Birri  
John Birri, Quality Assurance Chemist  
Monitoring Management Branch

Date:

3/31/87

APPROVED BY:

Gerard F. McKenna  
Gerard F. McKenna, Chief  
Monitoring Management Branch

Date:

4/2/87

Title: Evaluation of Inorganics Data for the  
Contract Laboratory Program

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## 1.0 Scope

- 1.1 This procedure is applicable to inorganics data obtained from contractor laboratories working for the contractor laboratories working for the Hazardous Waste Site Contract Laboratory Program (CLP).
- 1.2 The data validation is based upon analytical and quality assurance requirements specified in Solicitation, Offer and Award No. WA 85-J838, issued September 3, 1985 (SOW '785).

## 2.0 Monitoring Management Branch (MMB) Responsibilities

### 2.1 Data Review Coordinator (DRC)

- 2.1.1 Prepares and Transmits log of data to be validated to Program Support Branch (PSB).
  - 2.1.2 Prepares work schedules for MMB data reviewers and contractors.
  - 2.1.3 Signs off or designates Deputy Project Officer (DPO) to sign off on all data reviews.
- 2.2 MMB Data Reviewers will complete any of the following as designated by the DRC.

#### 2.2.1 For a Total Review (T)

- a. Data Assessment - Significant Element Review Checklist (Appendix A.1).
- b. Data Assessment - Data Acceptability Narrative (Appendix A.2).
- c. Data Assessment - Core Review Checklist (Appendix A.3).
- d. Contract Problems/Non-compliance (Appendix A.4).
- e. Data Summary Sheet - Summary of Inorganic Quality Control Data (Appendix A.5). NOTE: Values within contract limits do not have to be entered; simply enter a check mark or vertical line to indicate compliance.
- f. CLP Data Acceptability Summary Form (Appendix A.6). Fill out as necessary for each category. Place an "x" in boxes where analyses were not performed, or criteria do not apply.
- g. Data Review Log Each data reviewer will maintain a log of reviews to include:
  1. Review start date
  2. Review completion date
  3. Site name
  4. Case number

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- 5. Laboratory name
- 6. Number of samples reviewed
- 7. Hours worked
- 8. Reviewer's initials

- 2.2.2 For a Significant Element Review (SE) - All tasks described for a Total Review (2.2.1 above) except for the Data Assessment - Core Review Checklist (Appendix A.2). This type of review places more emphasis upon reviewing QC indicators (Forms II-X of Statement of Work 785) than upon reviewing for contract compliance and acceptability of raw data.
- 2.2.3 For a Documented Risk Review (DR)
  - a. Data Assessment - Documented Risk Review Checklist (Appendix A.6).
  - b. All tasks described for a Total Review (2.2.1 above) except for the Significant Element and Core Review Checklists.
- 2.2.4 Telephone Records Log - The data reviewer should enter the bare facts of the inquiry, before initiating any phone conversation with a CLP laboratory. After the case review has been completed, give two copies to MMB secretary for mailing to Sample Management Office (SMO). File the third copy in the appropriate folder.
- 2.2.5 Forwarded Paperwork - Upon completion of review, the following are to be forwarded to the Regional Sample Control Center (RSCC) located in the Surveillance and Monitoring Branch:
  - a. Data package
  - b. Completed data assessment checklist (original)
  - c. Surveillance and Monitoring Branch Review (Appendix A.7)
  - d. SMO Contract Compliance Screening (CCS)
  - e. Data Summary Sheet - Summary of Inorganics Quality Control Data (original)
  - f. Record of Communication (copy)
  - g. CLP Reanalysis Request/Approval Record (original + 3 copies)
  - h. A copy of the completed data acceptability narrative (Section A.1.5) is to be forwarded to the appropriate DPO.

Title: Evaluation of Inorganics Data for the  
Contract Laboratory Program**2.2.6 Filed Paperwork** - Upon completion of review, the following are to be filed within MMB files:

- a. Completed data acceptability narrative (Section A.1.5)
- b. Telephone Record Log (copy)
- c. Data Summary Sheet - Summary of Inorganics Quality Control Data (copy)
- d. Record of Communication (original)
- e. CLP Data Acceptability Summary Form (Appendix A.6)
- f. CLP Reanalysis Request/Approval Record (copy)
- g. SAS Analytical Services Request

**2.3 Contractor data preparer will complete any of the following as designated by the EPA Data Review Coordinator (DRC).****2.3.1 For a Total Review (T)**

- a. Data Assessment - Significant Element Review Checklist (Appendix A.1).
- b. Data Assessment - Core Review Checklist (Appendix A.2).
- c. Data Summary Sheet - Summary of Inorganic Quality Control Data (Appendix A.5). NOTE: Values within contract limits do not have to be entered; simply enter a check mark or vertical line to indicate compliance.

**2.3.2 For a Significant Element Review (SE)** - All tasks described for a Total Review except for the Data Assessment - Core Review Checklist (Appendix A.2).**2.3.3 For Documented Risk Review (DR)**

- a. Data Assessment - Document Risk Review Checklist (Appendix A.6)
- b. Data Summary Sheet - Summary of Inorganic Quality Control Data

**2.3.4 Telephone Record Log** - The data preparer should enter the bare facts for the inquiry before initiating any phone conversation with a CLP laboratory. After data preparation has been completed, mail two copies to the Sample Management Office (SMO), and attach third copy to data package.**2.3.5 Forwarded Paperwork** - Upon completion of data preparation, the following are to be forwarded to the EPA Data Review Coordinator in the following order:

- a. Record of Communication from Regional Sample Control Center (RSCC)
- b. Surveillance and Monitoring Branch Review (Appendix A.7)
- c. Additional information provided as part of CCS Report, and CCS Report itself

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- d. Telephone Record Logs
- e. Contractor narrative (if provided)
- f. Traffic Reports
- g. Completed Data Summary Sheet - Summary of Inorganics  
Quality Control Data (original)
- h. Cover Page
- i. Forms I through XIII
- j. Raw data:
  - 1) ICP
  - 2) Flame AA
  - 3) Furnace AA
  - 4) Mercury
  - 5) Cyanide
  - 6) Percent Solids (Soils/Sediments only)
  - 7) Digestion Logs
- k. SAS Analytical Services Request
- l. SAS Raw Data

2.3.6 Filed Paperwork - Upon completion of data preparation, the following are to be filed within contractor files.

- a. Completed data assessment checklist (copy)
- b. Surveillance and Monitoring Branch Review (copy)
- c. Telephone Record Log (copy)
- d. Record of Communication (copy)

2.3.7 Data Preparation Log - Each contractor will maintain a log of data packages prepared for assessment to include:

- a. Review start date
- b. Review completion date
- c. Site name
- d. Case number
- e. Laboratory name
- f. Number of samples reviewed
- g. Hours worked
- h. Reviewer's initials

### 3.0 Timeliness

3.1 All data will be reviewed no later than 15 days from stamped date of receipt at MMB.

3.2 An MMB authorized laboratory contact will contact SMO within one working day of discovery of an incomplete data package. DPO will again contact laboratory two weeks after first contact if data has not been received, and delay has not been reasonably explained.

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- 3.3 Incomplete data packages will not be held longer than six weeks from data of receipt of initial data package: data will be returned to Regional Sample Control Center (RSCC) accompanied by an explanation specifying which reported values could be considered validated and which were awaiting further data.
- 4.0 Data Completeness - Incomplete data package must be brought to the attention of the data review manager, or the DPO whenever the lack of any information would cause the rejection of data.
- 5.0 Rejection of Data - All values determined to be unacceptable on the Inorganic Analysis Data Sheet (Form I) must be lined over with a red pencil. As soon as any review criteria causes data to be rejected, that data can be eliminated from any further review or consideration.
- 6.0 Acceptance Criteria - In order that reviews be consistent among reviewers, acceptance criteria as stated in Appendices A.1, A.2, and A.3 should be used. Additional guidance can be found in the National SOP for inorganic data review.
- 7.0 SMO Contract Compliance Screening (CCS) - This is intended to aid preparer/reviewer in locating any problems, both corrected and uncorrected.
- 8.0 Request for Reanalysis - Data reviewers must note all items of contract noncompliance within Data Assessment Narrative (see pages 11 to 12 of this SOP). If holding time and sample storage times have not been exceeded, the Data Review Manager or DPO may request reanalysis if items of non-compliance are critical to data assessment. Requests are to be made on "CLP Re-Analysis Request/Approval Record".
- 9.0 Surveillance and Monitoring Review - Provided by the Regional Sample Control Center (RSCC). This identifies all samples by EPA sample number which should be included in data package, and also provides the Superfund Account number.
- 10.0 Record of Communication - Provided by the Regional Sample Control Center (RSCC) to indicate which data packages have been received and are ready to be reviewed.
- 11.0 SAS Analytical Services Request - Provided by the Regional Sample Control Center (RSCC), and indicates which methods of analyses and additional Quality Control criteria were requested.

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Title: Appendix A.1: Data Assessment - Contract  
Compliance (Significant Element Review)

Contractor Preparer \_\_\_\_\_ Completion Date \_\_\_\_\_

NOTE: All "action" requirements apply to data preparer, unless  
specifically stated otherwise.

	YES	NO	N/A
A.1.1 <u>Contract Compliance Screening Report</u> (CCS) - Present?	___	___	___
A.1.2 <u>Record of Communication (from RSCC)</u> - Present?	[___]	___	___
Action: If no, request from RSCC.			
A.1.3 <u>Sample Traffic Report</u> - Present or on file?	[___]	___	___
Action: If no, request from Regional Sample Control Center (RSCC).			
A.1.4 <u>Cover Page</u> - Present?	[___]	___	___
ACTION: If no, prepare Telephone Record Log, and contact laboratory.			
Do numbers of sample correspond to numbers on Record of Communication?			
	[___]	___	___
Do sample numbers on cover page agree with sample numbers on:			
a. Traffic Report Sheet?	[___]	___	___
b. Form I's?	[___]	___	___
c. Surveillance and Monitoring Branch Review	[___]	___	___
ACTION: If no for any of the above, contact RSCC for clarification.			
A.1.5 <u>Form I (Data Reporting)</u> - All present and complete?	[___]	___	___
ACTION: If no, prepare telephone record log and contact laboratory.			



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Title: Appendix A.1: Data Assessment - Contract  
Compliance (Significant Element Review)

	<u>YES</u>	<u>NO</u>	<u>N/A</u>
<b>A.1.6 <u>Holding Times</u> (Aqueous Samples Only)</b> (Examine Sample Traffic Reports and Form X)			
Mercury (28 days) - Exceeded?	___	[___]	___
Cyanide (14 days) - Exceeded?	___	[___]	___
Other metals (6 months) - Exceeded?	___	[___]	___
Conventionals (Use 40 CFR 136 criteria) - Exceeded?	___	[___]	___

Which Parameters? \_\_\_\_\_

CONTRACTOR ACTION: Prepare a list of all samples and analytes for which holding times have been exceeded. Specify the number of days from date of collection (see traffic report) to the date of analysis (from raw data). Attach to checklist.

MMB ACTION: If yes, reject (red-line) values less than Instrument Detection Limit (IDL). Flag as estimated (J) those values above IDL.

**A.1.7 Raw Data**

Digestion Log* for flame AA/ICP present?	[___]	___	___
Digestion Log for furnace AA present?	[___]	___	___
Digestion Log for mercury present?	[___]	___	___
Digestion Log for cyanides present?	[___]	___	___

\*Weights, dilutions, and volumes used to obtain the reported values.

Measurement readout record present?	ICP	[___]	___	___
	Flame AA	[___]	___	___
	Furnace AA	[___]	___	___
	Mercury	[___]	___	___
	Cyanides	[___]	___	___
Conventionals:	_____	[___]	___	___

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Title: Appendix A.1: Data Assessment - Contract  
Compliance (Significant Element Review)

	<u>YES</u>	<u>NO</u>	<u>N/A</u>
Record of 4 point calibration present? Flame AA	[ ]	—	—
Furnace AA	[ ]	—	—

NOTE: If less than 4, other standards must be run immediately after calibration, and be  $\pm$  5% of true value.

Record of 4 point calibration present? Mercury	[ ]	—	—
Cyanide	[ ]	—	—

Percent solids calculations present for soil (sediments)?	[ ]	—	—
-----------------------------------------------------------	-----	---	---

ACTION: If no for any of above, prepare Telephone Record Log and contact laboratory.

Was one prep blank analyzed for each 20 samples?	[ ]	—	—
--------------------------------------------------	-----	---	---

MMS ACTION: If no, flag as estimated (J) all data which prep blank was not analyzed.

NOTE: If only one blank was analyzed for more than 20 samples, then first 20 samples analyzed do not have to be flagged as estimated (J).

Do concentration of field blanks fall below two times IDL for all <u>aqueous</u> parameters?	[ ]	—	—
----------------------------------------------------------------------------------------------	-----	---	---

MMS ACTION: If no, reject (red-line) all data (except field blank) that has a concentration less than ten times the field blank value but not flagged with a "U" (less than).

A.1.8.1 Form II (Initial and Continuing Calibration

Verification

Present and complete?	[ ]	—	—
-----------------------	-----	---	---

ACTION: If no, prepare Telephone Record Log and contact laboratory.

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Title: Appendix A.1: Data Assessment - Contract  
Compliance (Significant Element Review)

	<u>YES</u>	<u>NO</u>	<u>N/A</u>
A.1.8.2 Circle all values on Data Summary Sheet that are outside of contract windows. Are all calibration standards (initial and continuing) within 75-125%?	<input type="checkbox"/>	___	___
Are all calibration standards (initial and continuing) within 50-150%?	<input type="checkbox"/>	___	___
MMB ACTION: Flag as estimated (J) all data analyzed between a calibration standard of 50-75% or 125-150% recovery and nearest adjacent calibration standards reject (red-line) as unacceptable data if recovery of calibration standard is below 50% or above 150% for nearest adjacent standards.			
A.1.9.1 <u>Form III (Blanks) - Present and complete?</u>	<input type="checkbox"/>	___	___
MMB ACTION: If no, prepare Telephone Record Log and contact laboratory.			
A.1.9.2 <u>Form III (Blanks) and Field Blanks</u>			
Circle all calibration blank values on Data Summary Sheet that are above IDL. Are all calibration blank values less than Contract Required Detection Limits (CRDL)?	<input type="checkbox"/>	___	___
MMB ACTION: If no, flag as estimated (J) on Form I all data between calibration blank with value over CRDL and nearest adjacent calibration blank.			
Was an initial calibration blank analyzed?	<input type="checkbox"/>	___	___
Was a continuing calibration blank analyzed after every 10 samples or every 2 hours (whichever is more frequent)?	<input type="checkbox"/>	___	___
CONTRACTOR ACTION: List those analytes which are out of compliance with the above criteria.			
MMB ACTION: If no, flag as estimated (J) all values not analyzed within 5 samples of calibration blank.			

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Title: Appendix A.1: Data Assessment - Contract  
Compliance (Significant Element Review)

	<u>YES</u>	<u>NO</u>	<u>N/A</u>
Do concentrations of prep blanks fall below two times IDL for all parameters?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MMB ACTION: If no, reject (red-line) all data that has a concentration less than ten times the prep blank value, but not flagged with a "U" (less than).			
A.1.10.1 <u>Form IV (ICP Interference Check Sample) - Present and complete?</u> NOTE: Not required for furnace AA, flame AA, mercury and Ca, K, Na, and Mg.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ACTION: If no, prepare Telephone Record Log and contact laboratory.			
A.1.10.2 <u>Form IV (ICP Interference Check Sample [ICS]) - Circle all values on Data Summary Sheet that are more than <math>\pm 20\%</math> of established mean value. Are all ICP Interference Check Sample results inside of control limits (<math>\pm 20\%</math> of true value)?</u>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
If no, is concentration of Al, Ca, Fe, or Mg lower in sample than in ICS?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MMB ACTION: If no, flag as estimated (J) those sample results for which ICS recovery is between $\pm 20\%$ to $50\%$ of mean value; and reject (red-line) those sample results for which ICS recovery is less than $50\%$ . If ICS recovery is above $150\%$ , reject <u>positive</u> results only (not flagged with a "U").			
A.1.11.1 <u>Form IX (ICP Serial Dilution) - Circle all values on Data Summary Sheet with a RPD greater than <math>10\%</math>. Are all ICP Serial Dilution results within control limit of <math>10\%</math> RPD?</u>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
If no, are all associated data on Form I's flagged with an "E"?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MMB ACTION: If not flagged with an "E" flag as estimated (J) all associated samples results for which RPD is greater than $10\%$ but less than $100\%$ ; reject (red-line) all associated sample results for which RPD is above $100\%$ .			

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Title: Appendix A.1: Data Assessment - Contract  
Compliance (Significant Element Review)

	<u>YES</u>	<u>NO</u>	<u>N/A</u>
NOTE: Either diluted or undiluted analysis may be used to report final value as long as either is above 10 times IDL.			

A.1.12.1 Form V (Spiked Sample Recovery) - Present and  
complete for each matrix type? NOTE: Not required  
for Ca, Mg, K, and Na (both matrix types), Al and  
Fe (soil only).

[ ] [ ] [ ]

ACTION: If no, prepare telephone record log and  
contact laboratory.

A.1.12.2 Form V (Spiked Sample Recovery)

Was field blank used for spiked samples?

[ ] [ ] [ ]

If yes, was field blank described as such on  
Traffic Report?

[ ] [ ] [ ]

MMB ACTION: Flag all data as estimated (J) for  
which field blank was used as spiked  
sample.

Was at least one spiked sample prepared and  
analyzed for: every 20 water samples?

[ ] [ ] [ ]

Every 20 soil/sediment samples?

[ ] [ ] [ ]

For both AA and ICP when both are used for same  
analyte?

[ ] [ ] [ ]

MMB ACTION: If no, flag as estimated (J) all data  
for which spiked sample was not  
analyzed. NOTE: If only one spiked  
sample was analyzed for more than 20  
samples, then first 20 samples analyzed  
do not have to be flagged as estimated  
(J).

Circle all values on Data Summary Sheet that are  
outside of control limits (75% to 125%).

Are all recoveries within control limits?

[ ] [ ] [ ]

If no, is sample concentration greater than four  
times spike concentration?

[ ] [ ] [ ]

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Compliance (Significant Element Review)

	<u>YES</u>	<u>NO</u>	<u>N/A</u>
ACTION: If no, circle those analytes on Form V for which sample concentration was not greater than four times the spike concentration.			

Are any spike recoveries: a) greater than 150%?	___	[___]	___
-------------------------------------------------	-----	-------	-----

b) less than 50%?	___	[___]	___
-------------------	-----	-------	-----

MMB ACTION: If greater than 150%, reject (red-line) all associated aqueous data not flagged with a "U" (less than value). Likewise, flag associated soil/sediment data as estimated (J) which are not flagged with a "U".

If less than 50%, reject (red-line) all associated data for aqueous samples only. Flag associated soil/sediment data as estimated (J).

A.1.13.1 Form VI (Lab) Duplicates - Present and complete for each matrix type?

[___]	___	___
-------	-----	-----

ACTION: If no, prepare Telephone Record Log and contact laboratory.

A.1.13.2 Form VI (Lab) Duplicates

Was field blank used for spiked samples?	___	[___]	___
------------------------------------------	-----	-------	-----

ACTION: If yes, flag all data as estimated (J) for which field blank was used as duplicate.

Was at least one duplicate sample prepared and analyzed for: every 20 water samples?	[___]	___	___
--------------------------------------------------------------------------------------	-------	-----	-----

Every 20 soil/sediment samples?	[___]	___	___
---------------------------------	-------	-----	-----

MMB ACTION: If no, flag as estimated (J) all data for which duplicate sample was not analyzed. NOTE: If only one duplicate sample was analyzed for more than 20 samples, then first 20 samples analyzed do not have to be flagged as estimated (J).

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	<u>YES</u>	<u>NO</u>	<u>N/A</u>
Circle all values on Data Summary Sheet that are outside of control limits (20% or CRDL).			
Are all values within control limits?	[ ]	—	—
<u>Aqueous</u>			
Is any RPD greater than 50% where <u>sample and duplicate are both greater</u> than 5 times CRDL?	—	[ ]	—
Is any difference between sample and duplicate greater than CRDL where <u>sample and/or duplicate is less</u> than 5 times CRDL, but greater than CRDL?	—	[ ]	—
MMB ACTION: If yes, reject (red-line) all associated data.			
<u>Soil/Sediment</u>			
Is any RPD greater than 100% where <u>sample and duplicate are both greater</u> than 5 times CRDL?	—	[ ]	—
Is any difference between sample and duplicate greater than 2 times CRDL where <u>sample and/or duplicate is less</u> than 5 times CRDL but greater than CRDL?	—	[ ]	—
MMB ACTION: If yes, reject (red-line) all associated data.			
A.1.13.3 Is "NC" reported in RPD column for any sample duplicate pair where either value is less than CRDL?	[ ]	—	—
MMB ACTION: If no, write in "NC" with red pencil on Form VI and initial. Note under Data Acceptability Narrative (contract non-compliance).			
A.1.14.1 <u>Form VII (Instrument Detection Limits [IDL] and Laboratory Control Sample [LCS])</u>			
IDLs present and complete?	[ ]	—	—
LCSs present and complete: aqueous?	[ ]	—	—
soil/sediment?	[ ]	—	—

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**YES      NO      N/A**

**YES      NO      N/A**

**YES      NO      N/A**

**YES      NO      N/A**

**YES      NO      N/A**

**YES      NO      N/A**

**YES      NO      N/A**

**YES      NO      N/A**

**YES      NO      N/A**

**YES      NO      N/A**

**YES      NO      N/A**

**YES      NO      N/A**

**YES      NO      N/A**

**YES      NO      N/A**

**YES      NO      N/A**

**YES      NO      N/A**

**YES      NO      N/A**



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Title: Appendix A.1: Data Assessment - Contract  
Compliance (Significant Element Review)

MMB ACTION: If yes, reject (red-line) affected data. YES NO N/A

Is coefficient of correlation less than 0.990 for any sample? \_\_\_ [\_\_\_] \_\_\_

MMB ACTION: If yes, reject (red-line) affected data.

A.1.15.3 Form IX (ICP Serial Dilutions)

Present and complete for each matrix type? [\_\_\_] \_\_\_ \_\_\_

ACTION: If no, write request on Telephone Record Log.

A.1.16.1 Dissolved Inorganics

Were any analyses performed for dissolved as well as total analytes? \_\_\_ [\_\_\_] \_\_\_

If yes, apply the following questions only if both dissolved and total constituents are above CRDL (For SAS parameters: above 5 \* IDL).

Is the concentration of any dissolved analyte greater than its total concentration by more than 10%. \_\_\_ [\_\_\_] \_\_\_

Is the concentration of any dissolved analyte greater than its total concentration by more than 50%? \_\_\_ [\_\_\_] \_\_\_

MMB ACTION: If more than 10%, flag both dissolved and total values as estimated (J); if more than 50% reject (red-line) the data for both values.

CONTRACTOR ACTION: Prepare a list comparing differences between all dissolved and total analytes. Compute the differences as a percent of the total analyte only when both dissolved and total concentrations are above CRDL (5 \* IDC for SAS parameters).

## Title: Appendix A.2: Data Assessment - (Core Review)

A.2.1 Data Verification

A.2.1.1 Choose at least one furnace AA parameter, one flame AA parameter, two ICP parameters, mercury and cyanide (if determined) for the initial evaluation process. If errors are encountered during review, perform the following:

- a. Furnace AA - evaluate all other furnace parameters for the type of error found.
- b. Flame AA/ICP - evaluate another two parameters for same type error(s), if still encountered, then all other parameters must be examined for same type of error(s).

A.2.1.2 For each parameter chosen for the initial evaluation, all deliverables (except for Form I's - see below) must be examined for computation and transcription errors and omissions.

A.2.2 Ten percent of Form I's (at least one) should be evaluated initially for computation, transcription errors and/or omissions. If errors are found, check all other Form I's for same type error(s).

A.2.3 Data Assessment Checklist

List Parameter(s) chosen as Initial Evaluation Parameters for

Furnace \_\_\_\_\_

Flame \_\_\_\_\_

ICP \_\_\_\_\_

List Samples (Form I's) chosen for initial review: \_\_\_\_\_

A.2.3.1 Form I (Data Reporting)

YES      NO      N/A

Was a brief physical description of sample given in comments section?

[ ]      \_\_\_\_\_

ACTION: If no, note exceptions under "Contract Problems/Non-Compliance" of data assessment narrative, or list separately and attach to checklist.

Do any computation/transcription errors exceed 10% of reported values?

\_\_\_\_\_ [ ] \_\_\_\_\_

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Title: Appendix A.2: Data Assessment - (Core Review)

	<u>YES</u>	<u>NO</u>	<u>N/A</u>
ACTION: If yes, prepare Telephone Record Log, and contact laboratory for corrected data.			
Are all "less than" values properly coded with a "U"?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ACTION: If no, write request for corrected data on Telephone Record Log, and red pencil affected data with "U" on Form I and initial.			
Were any samples diluted beyond requirements of contract?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
If yes, were dilutions noted under Comments Section of Form I?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ACTION: Note under "Contract Problems/Non-Compliance" of data assessment narrative.			

A.2.3.2 Form II (Initial and Continuing Calibration Verification)

Do any computation/transcription errors exceed 10% of reported values?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ACTION: If yes, request corrected data and prepare Telephone Record Log; correct errors with red pencil and initial.			
Does Raw Data Record agree with weights and volumes required by CLP methods?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ACTION: If no, prepare Telephone Record Log, and contact laboratory for explanation.			

A.2.3.3 Linear Range

Was any sample result (raw data) higher than highest calibration standard (except ICP) or linear range (Form XIII) by more than 10%? (Note: Form XIII provided only quarterly.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MMB ACTION: If yes, flag result reported on Form I as estimated (J).			

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Title: Appendix A.2: Data Assessment - (Core Review)

	<u>YES</u>	<u>NO</u>	<u>N/A</u>
<b>A.2.3.4 <u>Form III (Blanks)</u></b>			
Do any computation/transcription errors exceed 10% of reported values?	___	[ ]	___
ACTION: If yes, prepare Telephone Record Log, contact laboratory for corrected data and correct error with red pencil and initial.			
<b>A.2.3.5 <u>Form IV (ICP Interference Check Sample (ICS))</u></b>			
Do any computation/transcription errors exceed 10% of reported values?	___	[ ]	___
ACTION: If yes, prepare Telephone Record Log, contact laboratory for corrected data and correct error with red pencil and initial.			
Was ICS analyzed at beginning and end of run (and at least once every 8 hours)?	[ ]	___	___
MMB ACTION: If no, flag as estimated (J) all samples for which AL, CA, Fe or MG is higher than in ICS.			
<b>A.2.3.6 <u>Form V (Spike Sample Recovery)</u></b>			
Do any computation/transcription errors exceed 10% of reported values?	___	[ ]	___
ACTION: If yes, prepare Telephone Record Log, contact laboratory for corrected data and correct errors with red pencil and initial.			
<b>A.2.3.7.1 <u>Form VI (Duplicates)</u></b>			
Do any computation/transcription errors exceed 10% of reported values?	___	[ ]	___
ACTION: If yes, prepare Telephone Record Log, contact laboratory for corrected data and correct error with red pencil and initial.			

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A.2.3.7.2 Field Duplicates

Were field duplicates analyzed?

YES      NO      N/A

\_\_\_ [\_\_\_] \_\_\_

ACTION: If yes, prepare a list of duplicate results and corresponding RPD. Apply CLP results criteria, and circle all values outside of contract/limits.

Aqueous

Is any RPD greater than 50% where sample and duplicate are both greater than 5 times CRDL?

\_\_\_ [\_\_\_] \_\_\_

Is any difference between sample and duplicate greater than CRDL where sample and/or duplicate is less than 5 times CRDL, but greater than CRDL?

\_\_\_ [\_\_\_] \_\_\_

MMB ACTION: If yes, reject (red-line) associated data for field duplicates only.

Soil/Sediment

Is any RPD greater than 100% where sample and duplicate are both greater than 5 times CRDL?

\_\_\_ [\_\_\_] \_\_\_

Is any difference between sample and duplicate greater than 2 times CRDL where sample and/or duplicate is less than 5 times CRDL but greater than CRDL?

\_\_\_ [\_\_\_] \_\_\_

MMB ACTION: If yes, reject (red-line) all associated data for field duplicates only.

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Title: Appendix A.2: Data Assessment - (Core Review)

	<u>YES</u>	<u>NO</u>	<u>N/A</u>
<b>A.2.3.8</b> <u>Form VII (Instrument Detection Limits (IDL) and Laboratory Control Sample (LCS))</u>			
Do any computation/transcription errors exceed 10% of IDL and/or LCS values?	___	[___]	___
ACTION: If yes, prepare Telephone Record Log, contact laboratory for corrected data and correct error with red pencil and initial.			
Was at least one LCS analyzed for every 20 <u>aqueous</u> samples?		[___]	___
CONTRACTOR ACTION: List exceptions and attach to checklist.			
MMB ACTION: If no, flag as estimated (J) all <u>aqueous</u> data for which LCS was not analyzed. NOTE: If only one LCS was analyzed for more than 20 samples, then first 20 samples analyzed do not have to be flagged as estimated (J).			
<b>A.2.3.9</b> <u>Form IX (ICP Serial Dilution)</u>			
Do any computation/transcription errors exceed 10% of reported values?	___	[___]	___
ACTION: If yes, prepare Telephone Record Log, contact laboratory for corrected data and correct error with red pencil and initial.			
<b>A.2.3.10</b> <u>Furnace AA Results</u>			
Were duplicate injections analyzed for each sample?		[___]	___

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YES    NO    N/A

MMB ACTION: If no, reject (red-line) all positive (not flagged with a "U") results.

CONTRACTOR ACTION: List all exceptions and attach to checklist.

For any concentrations above CRDL do duplicate injections agree to within  $\pm 20\%$  RSD?

[ ]    —    —

If no, was analysis repeated at least once?

[ ]    —    —

MMB ACTION: If no, flag result reported on Form I as estimated (J) when RSD is between 20 to 50%. If RSD is above 50%, reject (red-line).

If yes, was second run within  $\pm 20\%$  RSD?

[ ]    —    —

MMB ACTION: If no, do as above.

A.2.3.11 Form VIII (Standard Addition Results)

Are any MSA analyses missing from Form VII?

—    [ ]    —

Do any computation/transcription errors exceed 10% of reported values?

—    [ ]    —

ACTION: If yes, prepare Telephone Record Log, contact laboratory for corrected data, and correct errors with red pencil and initial.

Was "special quantitation procedure" followed correctly?

[ ]    —    —

ACTION: If no, note exceptions under "Contract Problems/Non-Compliance" of data assessment narrative, or prepare a separate list.





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**Title: Appendix A.3: Data Acceptability Narrative**

## This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper has a slightly textured appearance and some minor blemishes or dust specks. The edges of the paper are slightly irregular.

[illegible]

STANDARD OPERATING PROCEDURE

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Title: Appendix A.7: CLP Data Assessment Checklist  
Inorganics Analysis

SURVEILLANCE AND MONITORING BRANCH REVIEW

Project Name/Site: \_\_\_\_\_

Case Number: \_\_\_\_\_

Type Investigation (Circle One): Remedial Site Other \_\_\_\_\_

Contract No.: \_\_\_\_\_

Laboratory: \_\_\_\_\_

Sample Identification Numbers:

Aqueous: \_\_\_\_\_

\_\_\_\_\_

Soil/Sediment: \_\_\_\_\_

\_\_\_\_\_

Superfund Account No.: \_\_\_\_\_

Comments: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

### SUMMARY OF INORGANICS QUALITY CONTROL DATA

PI 'O(S): \_\_\_\_\_

FIELD BLANK SAMPLE NO(S): \_\_\_\_\_ FIELD DUPLICATES: \_\_\_\_\_

[illegible]

NLI 001 0888

APPENDIX A.3

CLP DATA ACCEPTABILITY SUMMARY FORM (INORGANICS)

Type of Review: \_\_\_\_\_ Date: \_\_\_\_\_ Case #: \_\_\_\_\_

Site: \_\_\_\_\_ Lab Name: \_\_\_\_\_

Reviewer's Initials: \_\_\_\_\_ Number of Samples: \_\_\_\_\_

I. Analytes Rejected Due to Exceeding Review Criteria:

	Holding Time	Calibration	Prep. Blank	Field Blank	Interfer- ences	Spike Recovery/ LCS	Duplicates Lab Field	Detection Limits	Analytes No. of Samples	Serial Dilution	% Rejected
ICP											
Flame AA											
Furnace AA											
Mercury											
Other											

II. Analytes Flagged as Estimated (J) Due to Exceeding Review Criteria:

											% as Estimated
ICP											
Flame AA											
Furnace AA											
Mercury											
Other											

NOTES:

Asterisk (\*) Indicates additional exceedances of review criteria.

3246b

6880 100 17N NLI 001 0889